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CONTENTS.

Editorial 168
The International Electrical Congress of 1904 at St. Louis 168
Programme of Edison Convention 168
A New Jersey Elevated Road 168
New German Electric Lighthouse 168
The Schuckert Electric Works at Nuremberg, Germany. By S. N. Taylor, Ph. D. 169
Production of Platinum in 1902 172
The Lodge-Muirhead System of Wireless Telegraphy. By A. Frederick Collins 173
The Milan-Gallarate Electric Railway. By P. Letheule 177
The Mechanical Cause of Gravity. By Robert Stevenson 179
A Rotary High-Frequency Interrupter. By M. Eastham 181
An Electrically Operated Coal Hoist. By Richard Lamb, C. E., E. E. 182
Large Power Plant Projected on Grand River in Colorado 183
Power Cable Conduits at Niagara 184
New Telephone Patents 184
Recent Electrochemical Developments 185
Profit Sharing for Telephone Employees 185
Electrical Development in Madagascar 186
Cabling the News of the Pope's Death 186
Telephone Tax Values in New York State 186
Underground Wires in Lower New York 187
Current News and Notes 187
LETTERS TO THE EDITORS:
Three-Phase Power Measurement. By Henry Pikler 188
Technical Trade Requirements in the Philippines. By Henry D. Woolfe 188
Digest of Current Electrical Literature 189
New Books 193
"Meridian" Lamp 194
Combined Ammeter and Voltmeter 194
Electric Motors on the Canals 195
Dynamo and Motor Production in Chicago 195
Clark Wireless Telegraphy 195
A Large Commutator 196
Spectacular Effects at the Contractors' Convention 196
Stone Pipe for Underground Conduits 196
High Tension Oil Switch 197
The Steel Industry at Niagara Falls 197
Bath Electric Tramways, England 198
New Double Incandescent Sign Lamps 198
Mining Locomotives for De Beer's Consolidated Mines 198
Arc Works, Chelmsford, England 199
Vacuum Pump 199
Testing Batteries in Gasoline Automobiles 199
News of the Week 200

FOREIGN CUSTOMERS.

A letter is published in this issue from a reader in Manila, with regard to care to be exercised in sending commercial information to the Philippines in respect to electrical apparatus. It will be noted that Mr. Woolfe complains that not less than sixty per cent. of the data is defective, thus affecting not only possible sales, but ease in passing goods through the customs. We direct attention to this communication because it is more or less a duplicate of other letters from various parts of the world, especially where English is not in common use, suggesting that those who are reaching out for foreign orders must study up in regard to these requirements. Sometimes the complaints relate also to difficulties in the terms of sale, or deficiencies in the methods of packing.

There must, of course, be more or less physical and other friction and "resistance" in carrying on foreign trade, but it is evident that a great deal of it can be cut out, with benefit to seller and purchaser, and with increase in business not only as between our manufacturers and their new markets, but as between exporters to this country and their customers. It should certainly be a part of the higher commercial education of the day to master the technique of such intercourse, and to lessen by better comprehension the barriers interposed by tariffs, differences of language, variations of practice, and the accidents of transportation. The modern régime of electrical communication has done much to improve conditions in this field, by facilitating and quickening the interchange of ideas and intelligence, and every new cable lessens the barbaric meaning of the word "foreign," in its old, pre-cable sense.

FOREIGN TRADE.

It is obvious that the foreign trade of the United States is approaching a period of development attended by no little uncertainty and perplexity. For the last four or five years during the régime of redundant prosperity—a prosperity which is still happily with us—the manufacturing resources of the country have not been equal to the demands upon them, so that imports have been tremendously stimulated, even in articles that were previously being exported in large quantities, and at higher prices than had prevailed for many years previous. The increases in productive capacity have now, however, overtaken consumption, as would only be natural, in spite of increased power of absorption; and the questions that begin to arise are whether the present ratio between exports and imports will continue; whether the importations may not slacken, and whether the process of pushing American exports into all quarters of the globe will not be resumed with renewed vigor. The United States has apparently advanced from fourth place in the list of exporting nations to the first, by a narrow margin, so that the problem is whether it is to widen the gap or to fall back in the scale.

In Europe some fears are entertained, we note, as to the return of the wave of American trade invasion, but such anxiety seems to us exaggerated. It will certainly be difficult for manufacturers who have dropped the threads of their foreign connections to pick them up again, for that is one of the most difficult things in international commerce; and in the meantime there has been a marked revival of European activity and energy in the supply of goods to foreign markets. But the main point is that trade is reciprocal, and tends whether aided by wise legislation or not to put itself on a reciprocity

basis. Besides, trade grows as the wants of a larger civilized area increase; and particularly with regard to new specialties like electrical apparatus, does an ever widening field present itself to view. We are inclined, therefore, on the whole, to expect with complacency the maintenance of a large aggregate of foreign trade, export and import, believing that all parties profit by it in liberal measure. We are also inclined to think that the growing tendency of foreign nations to buy manufactured goods from us can only be maintained by ability to purchase, which in turn is assisted not alone by our purchases from them but by the cheapness and excellence of what they buy from us.

A WIRELESS TELEGRAPH SQUABBLE.

For some weeks the correspondence columns of our London contemporary, *The Electrician*, have been the medium of a controversy which in bitterness of spirit displayed by the participants and, per contra, in amusement to the disinterested reader, is unique. The controversy had its origin in a letter written to the *London Times* by Prof. Fleming, who complained of a "cowardly and concealed attempt" to spoil a demonstration of the Marconi system of wireless telegraphy at a lecture delivered by him on June 4 before the Royal Institution. A Mr. Nevil Maskelyne immediately admitted publicly that he was an accomplice in the aforesaid attempt, the disturbance consisting in "the simple interjection of the word 'rats.'" In another communication, after accusing Prof. Fleming of falsehood, he said that the outside interference which disturbed the lecture was to determine if a simply untuned radiator could upset the tuned Marconi receiver—which Prof. Fleming's lecture proves was done. In a letter following this Prof. Fleming denied that the exhibition interfered with was intended as a demonstration of the Marconi syntony system, accused Mr. Maskelyne of making absolutely untrue allegations and of being guilty of "a piece of scientific hooliganism of the worst possible description." In a rejoinder Mr. Maskelyne endeavors by a series of quotations to convict Prof. Fleming of—well, tergiversation—and ends by reminding him that abuse is no argument.

At this point the controversy is taken up in our electrical contemporary, through which it has continued for a month, and with no sign of abatement. The first letter is from Prof. Fleming, in which he reiterates that he was not giving at the Royal Institution a demonstration of the reliability and efficacy of Marconi syntony, but showing an experiment for a totally different purpose—a somewhat ambiguous plea. In the following issue Mr. Maskelyne renews his contention that the experiment with which he interfered did relate to Marconi syntony. "Mr. Marconi," he said, "is constantly telling what he can do, but he never does it, the result being that he and his associates are subject to criticisms, experimental tests and a general surveillance from which otherwise they would be exempt." As to Prof. Fleming, his opponents merely ask, "What is he doing, then, in that galley?" In a following issue he asserts that no message was sent from Poldhu before 11.50 A. M., and he calls upon Prof. Fleming to explain the mystery as to the source of the messages stated to have been received earlier in the morning. In the last issue of the journal at hand, Mr. Maskelyne admits that a message was on June 4 repeated from Poldhu at intervals, five times, though its wording was not exactly that of the message received at the Royal Institution—this, however, not in any way affecting his statement as to the operations carried on during the hours to which the controversy relates. To the same issue the Marconi Wireless Telegraph Company contributes two letters, one of which gives transcripts of messages sent to and from the Royal Institution on June 4, and another of later date asking the editor if he had shown or communicated to Mr. Maskelyne this letter. In an editorial note this insinuation is repudiated with the comment, "Never has a more base insinuation been made, and it is difficult to understand what motive prompted this communication from the company." Without touching on the merits of this curious controversy, it may be said that its tone shows unhappily again the jingo spirit in which the wireless telegraph situation has been uniformly treated in Great Britain.

CONNECTIONS FOR TRANSMISSION SYSTEMS.

Mr. Peck's discussion of Mr. Blackwell's Institute paper is one of the most useful contributions to the literature of practical power transmission that we have seen for a long time. It deals with the subject of voltages on grounded and ungrounded three-phase circuits with an encyclopædic spirit that makes it especially valuable for ready reference, and takes up cases which from their infrequent occurrence would usually escape attention. What is still more to the point, it discusses the effect of entirely accidental and abnormal grounds. The troubles in transmission systems are not generally due to accidents of a commonplace character, for these are to a large extent preventable, but to curious and entirely unexpected occurrences that may produce very grave trouble of a kind not to be easily foreseen. If any one had predicted a year ago, for instance, that the Niagara station would be shut down by an accident within the power house, he would have been greeted with unseemly scoffing, and yet the thing happened. We drew the moral at the time, but it is quite safe to say that there will be plenty of other accidents elsewhere, equally impossible and unforeseen. In three-phase working there is a growing tendency to employ the grounded star connection to limit the voltage between wires and earth, or what amounts to the same thing, to increase the working voltage of transmission without increasing the voltage between wires and earth. The advantage in copper to be gained by this in case a neutral wire is employed is very considerable, as is well known—as great as that gained by working the three-wire system on continuous current distributions—and from the standpoint of fire risk the gain in safety over an underground system at the same working voltage is also very material.

Nevertheless, grounding is not without its added responsibilities and, as Mr. Peck shows, these are mainly concerned with the voltage distortions which result from the short-circuiting of transformers by grounding or otherwise. The effect of the distortion thus superinduced may be great enough to more than double the voltage across certain of the lines under certain conditions and with certain connections. To catalogue the conditions and their effects would be to cite bodily Mr. Peck's tables, to which reference should be made for particulars. Some things, however, are worth noting. Either pure star, grounded generator and all, or pure mesh connections are safe enough from abnormal voltages. Of the mixed systems in common use, most are somewhat liable to the chance of getting abnormally high voltages on some part of the circuit, of which the chance of a short circuit on a raising transformer is the most likely cause. With one branch of a raising mesh out there is a beautiful chance for trouble ahead. The moral is that the high-voltage transformers must be kept out of mischief by particular care. In ordinary practical operation the crippling of a raising or reducing transformer puts the circuit so thoroughly out of business that the distribution of voltages becomes a matter of secondary importance anyhow. Any system of operation which saves copper is liable to serious derangement of the voltages in its respective parts, and in using such a system, whether the common three-wire or some strange and com-

plex polyphase system, it ought to be distinctly understood that one has to pay a reasonable price in care for the saving in cost of conductors. In the early days of the three-phase system it was a constant source of joy to the unregenerate to see the continuous current contingent, whose daily food was balancing and boosting, howling about the dreadful result of unbalanced load on a three-phase system. It is doubtless true that with the feeder drop common in direct-current practice, a three-phase distribution would be in a bad way; but this is all ancient history now, and we recur to the grounding question.

In our opinion, considered merely as a safety precaution, the grounded neutral is decidedly to be recommended. It unquestionably requires a little more care than an ungrounded system, but it reduces the main risks very materially. Incidentally, it allows the safe use of working transmission voltages which otherwise would have to be classed as somewhat hazardous. What is more, those plants which have adopted the plan find that it causes far less inconvenience than they were prepared to meet. Whether a system should employ a star system which permits grounding, is a question to be decided on its merits. Where a large secondary distribution is to be attempted, the saving in copper by using a star with neutral is so great that it will commonly be used whatever the connections back of it may be. And these latter connections should certainly be considered in the light of such posibilities as Mr. Peck has described. But in many cases the connection can be chosen without reference to any extended network, and the choice will generally fall on one of the mixed systems. Pure mesh connection in large plants has fallen into partial disuse, and the advantage, of which much was once made, in using two of the transformers to form a resultant mesh, has been proved to be of very little moment. Few who have tried it on a large scale would care to repeat the experiment, and on the scale of most recent plants, the gain in using two transformers instead of three is negligible. At present the whole question is largely a matter of convenience.

INTERNATIONAL ELECTRICAL STANDARDIZATION.

One of the most important recent developments of electrical engineering has been in the establishment of rules for the standardization of electrical machinery. Such rules have been prepared by the American Institute of Electrical Engineers in this country, by the Verband Deutscher Electrotechniker in Germany, and similar rules are under contemplation in other countries. Moreover, the Fire Insurance Associations in various countries have formulated rules of a different character, but which nevertheless bear some relation to the subject of standardization. Standardization rules exercise an important influence upon electrical engineering by adding precision to terminology, and by adding conventional concert to matters that would otherwise be left optional or uncertain. Moreover, they tend to prevent misunderstandings between manufacturer and purchaser, by eliminating uncertainty from the technical terms of contracts. Further, the standardization of types of machinery tends to reduce the cost of manufacture, and, therefore, the price to the purchaser.

It is of importance to electrical engineering industry that standardization rules should be made uniform all over the world. The same reasons which urge the introduction and maintenance of such rules in a single country are applicable to the extended application of such rules over different countries. As matters stand to-day, the rating of a dynamo, as expressed in kilowatts, is different in America and in Europe. This is essentially unfortunate. The physical tests which determine the output of a dynamo should be the same everywhere. In other words, a machine which has a rated output of, say, 500 kilowatts in one country, by reason of its temperature elevation under load, or other physical characteristic, should possess the same rating in all other countries. Otherwise, manufacturers of electrical machinery cannot be brought to a footing of uniform competition without tedious investigations and adjustment of specifications. Similarly, all definitions of the same or of corresponding technical terms should be exactly alike in all countries, in order to avoid the possibility of international misunderstanding in the specification or description of electrical machinery. Again, the margin of reserve in heating, or in other physical behavior, which should belong to a machine in view of possible overloads, should be normally the same in all countries, so as to ensure equality of rating under all conditions of service. This uniformity of international standardization does not exist at the present time.

It seems desirable, therefore, that an international standardization should be attempted, in order to reconcile the differences in detail which already exist upon such questions in different countries. The mechanism by which such an international standardization might be effected lies under the command of any international electrical congress. For example, the next electrical congress, which is scheduled to convene next year at St. Louis, might appoint a committee on standardization which should have its members chosen from the various countries principally interested in electrical engineering development. This committee might be instructed to consider the situation of standardization as it exists at present in different parts of the world, and to report at some future time upon an international code that would meet with the indorsement not merely of the various electrical engineering institutions or associations of engineers here and abroad, but also of the various industrial interests dealing with the manufacture of electrical machinery. Even if the efforts of such a committee looking towards the realization of international standardization were but partially successful, the effort would not have been made in vain. For instance, if only two countries could be persuaded to agree upon a set of rules, while other countries did not conform, the union of two countries on the project would be worth striving for.

It is evident that the chances of success in securing international conformity would depend in large measure upon the extent of the proposed international rules. Conformity would almost certainly be assured if the rules were limited in their scope to mere matters of terminology and definition. On the other hand, conformity would be almost hopeless, if the rules were attempted to be carried into matters of minute industrial detail, such as the best series of sizes for dynamos, or the best series of speeds for the same. Local custom and commercial precedent would probably render international uniformity impossible in such matters. Somewhere between these two extremes, consensus of opinion might be expected to be reached. Thus, there is no reason why a dynamo machine should not have one and the same rating in power all over the world, both as to full load and as to overload. Similarly, there is no reason why the efficiency or the regulation of an engine-driven alternator should not be reckoned in the same way all over the world. It would probably require at least a year for any committee, appointed on the subject, to reach a useful conclusion and file its report. It might not even be possible to secure a report before the convention of the next ensuing international electrical congress. But while no harm could apparently be done by such a committee, whether successful or not, there can be no doubt that great benefit would accrue to its successful accomplishment of the task imposed.

The International Electrical Congress of 1904 at St. Louis.

As is already known to many of our readers, it has been decided to hold an international electrical congress at St. Louis next year, in connection with the Universal Exposition. The date selected is the second week of September (12th-17th). The advantage of that period is that it offers the most convenient compromise between hot weather on the one hand, and the terminating limits of fall vacations on the other. If the date were set earlier, the weather at St. Louis might be found uncomfortably warm. If the date were postponed, it might be difficult for electrical workers on vacation to meet their fall engagements. Moreover, the week selected immediately precedes the great scientific congress appointed by the St. Louis Exposition, which convenes during the third week in September. Since many distinguished visitors and guests will attend the scientific congress, it is the more probable that a good attendance can be secured for the electrical congress immediately preceding.

The international electrical congress will, according to the present plan, comprise three distinct features: namely, first, a chamber of delegates appointed by governments; second, the main body of the congress divided into sections; third, conventions simultaneously held by various electrical organizations in the United States. The last international electrical congress was held at Paris in 1900. The next preceding was Chicago in 1893. The representatives in the chamber of delegates are nominated by the various foreign governments and by the United States. The chamber of delegates considers and votes upon such international questions as units and standards. There are various questions involving units and standards, which might properly occupy the attention of a chamber of delegates next year.

The sections which have been proposed for the main body of the congress are:

General Theory—Section A			Mathematical. Experimental.
Applications	"	B	General Applications.
	"	C	Electrochemistry.
	"	D	Electric Power Transmission.
	"	E	Electric Light and Distribution.
	"	F	Electric Transportation.
	"	G	Electric Communication.
	"	H	Electrotherapeutics.

It is expected that prominent electrical men in various parts of the world will be invited to contribute special papers on subjects in the various sections and their subdivisions.

Several of the prominent electrical organizations of the country have already taken steps to hold their conventions in St. Louis during the electrical congress week. It is hoped that all of the following bodies will complete arrangements to this effect: The Americal Institute of Electrical Engineers, the Electrochemical Society, the National Electric Light Association, the Association of Edison Illuminating Companies, the American Street Railway Association, the Pacific Coast Electrical Transmission Association, the American Electrotherapeutic Association. Some plan is expected to be made whereby a joint meeting or meetings may be held between each section of the congress and the particular national organization interested in that subject. In this manner, mutual advantages in membership, discussion and publication ought to be secured.

The transactions of the congress should form a very attractive and important publication not only as associated with the St. Louis Exposition, but also indicative of the world's progress in electromagnetism and its applications. The congress arrangements are in the hands of a committee of organization consisting of thirty-three members, all active representatives of American electrical progress. Prof. Elihu Thomson has been elected president. No other man in the country is so well fitted for the post, since he has united for many years the support of scientific, industrial and inventive electrical interests.

The vice-presidents are Prof. H. S. Carhart, of the University of Michigan, whose work is so well known in connection with electrical standards of e.m.f.; Mr. C. F. Scott, the retiring president of the American Institute of Electrical Engineers; Mr. B. J. Arnold, the incoming president of the same organization; Prof. W. E. Goldsborough, the active director of the Department of Electricity at the St. Louis Exposition; and Dr. W. S. Stratton, the director of the National Bureau of Standards.

Meetings of the Executive Committee and of the Advisory Committee have already been held. The work of preparing for the congress is already in progress. All communications should be addressed to the general secretary, Dr. A. E. Kennelly, Harvard University, Cambridge, Mass.

Programme of Edison Convention.

The nineteenth annual meeting (twenty-fourth convention) of the Association of Edison Illuminating Companies will be held at the Frontenac, Thousand Islands, St. Lawrence River, N. Y., September 8, 9 and 10, 1903. A number of valuable papers are in course of preparation on subjects pertaining to the business of the member companies, and already there are indications which point to the coming convention as probably the most valuable of a long series of excellent meetings. The Edison Association was organized in 1885 by companies licensed under the Edison patents. It embraces all of the present licensees under these patents, excepting only a very few.

The Edison conventions are noted for their close attention to business, the absence of mere junketing, and the higher beneficial results to its members. The place of meeting this year is selectd because of the absence of outside allurements, with the expectation that this convention will exceed all others in the strict devotion to work. At the proper time a list of the papers presented and subjects discussed will be given by the technical press. Following is a list of the officers of the Association: President, Mr. Louis A. Ferguson, Chicago, Ill.; vice-president, Mr. A. W. Field, Columbus, O.; treasurer, Mr. Alex. Dow, Detroit, Mich.; secretary, Mr. Walter H. Johnson, Philadelphia, Pa.; assistant secretary, Wilson S. Howell, New York, N. Y.

A New Jersey Elevated Road.

A scheme is being pushed for an electric elevated railroad from Hoboken to the Oranges and Montclair and extensions to Summit. The plan contemplates a ferry at Fourteenth Street, New York City. The company is to be known as the Elevated Electric Railway of New Jersey, and it was originally planned to be built at a cost of $2,000,000, including the right of way and equipment. Leaving the ferry, a tunnel was to run in Hoboken for a distance of 4,600 ft., and the estimated cost is placed at $450,000. The tunnel is planned to be 25 ft. wide and 16 ft. high. The map shows the proposed line to run over Pen Horn Creek and Hackensack River, paralleling the Lackawanna and Erie tracks on the meadows and running between them through Kearny, over the Passaic River to Mount Prospect Avenue, Newark, and thence to Orange. The plans provide for a power house on the meadows and drawbridges over the rivers. The trestle is planned to be about 22 ft. high. Mr. James S. Holmes, of Orange, N. J., says the scheme is entirely practicable, and he believes that the road will be built.

New German Electric Lighthouse.

Note is made in Consular Reports of a new electric flash light on the Island of Heligoland, in the North Sea, equipped with a Schuckert parabolic glass mirror. "Experiments were made in Nuremberg. They went far beyond what the most sanguine had believed possible. The revolving reflector of the German apparatus was fully equal to the best French revolving light. As soon as the experts had demonstrated their point, work was begun on a light reflector or projector equal to the largest ever used. It was to represent 30,000,000 cp., and to flash no longer than one-tenth of a second. The flashes must follow each other every five seconds. The flash light illumines the entire horizon. In normal weather it may be seen 23 sea miles (23 leagues). On the first night that the new light was used, its peculiar, flashing beams were seen by people standing on the mole at Busum, a distance of 65 kilometers, or a trifle over 40 miles. The watchers in the lighthouse at Amrum, about the same distance, were able in unfavorable weather to see the same beams as they rapidly appeared and disappeared. It was noted that the otherwise bluish-white light of the electric arc appeared red."

The Schuckert Electric Works at Nuremberg, Germany.

BY S. N. TAYLOR, PH. D.

THE home works of the Schuckert Company, which company on April 1 combined with the Siemens & Halske Company, are located at Nüremberg, and there is no electrical establishment in Germany more perfect in construction or more complete in its appliances. It is usually difficult to gain access to electric works, and this is especially true of the electric works in Germany. It was due to the friendship and influence of Prof. Wiedemann that the writer was permitted to visit all parts of the Nuremberg works, even the departments where visitors are not usually allowed, and that special opportunities were afforded him of studying all the machinery and apparatus manufactured there.

The first impression upon a stranger visiting the "New Works" for the first time is given by the splendid buildings the company has erected for manufacturing purposes. In American manufactories, if the buildings are large enough and strong enough and adequately equipped, we are apt to think but little about appearances, but the latter point has not been neglected at the Schuckert Works. The buildings, which are of brick and trimmed with brown sand stone, are unusually attractive in design and finish. No care nor expense has apparently been spared in their construction, either in exterior or interior, to make them as nearly perfect as possible for the purposes intended.

The interiors of the administration buildings are especially noticeable in this respect. The various offices are large and light and many of the departments are very handsome, the ceilings, doors, etc., being finished in curled maple inlaid with other ornamental woods highly polished, while the walls are neatly frescoed. The furniture, carpets, etc., in the rooms are in keeping with the finish.

The same care and attention to the completeness and perfection of each department is conspicuous throughout all the works. The machine shops, testing rooms, laboratories, etc., though naturally plain, are very durably built, roomy, light and well adapted to the purposes for which they are used. Some of the machinery departments are even very handsome. This is especially true of the central power station from which power is supplied to the various departments. The rooms are finished in hard woods, with frescoed walls, the floors are of polished tile, protected by carpets, the machinery and engines are polished and burnished till they glisten like mirrors, and they run so smoothly that there is scarcely a sound to be heard. All these combined tend to give one the impression of being in a very elaborate and well-furnished parlor, rather than that of the engine rooms of a large factory. These features in a German manufacturing establishment seem all the more striking to a stranger when considered in connection with the fact that so many of the German homes are so lacking in the attractiveness and home comforts which Americans look for.

But while speaking of the completeness and perfections of the Schuckert buildings, it should be mentioned before going further, that the machinery and instruments produced here are not less noteworthy for their beauty of finish and perfection of construction.

The Nüremberg Works at present comprise the "Old Works" and the "Three New Works." The "Old Works" are the buildings which were formerly occupied by the company for manufacturing purposes, but having become inadequate to the needs of the company, the extensive "New Works" were erected in 1888, and since then, so that now only the "New Works" are used for manufacturing purposes, the "Old Works" having been refitted by the company for various benevolent purposes.

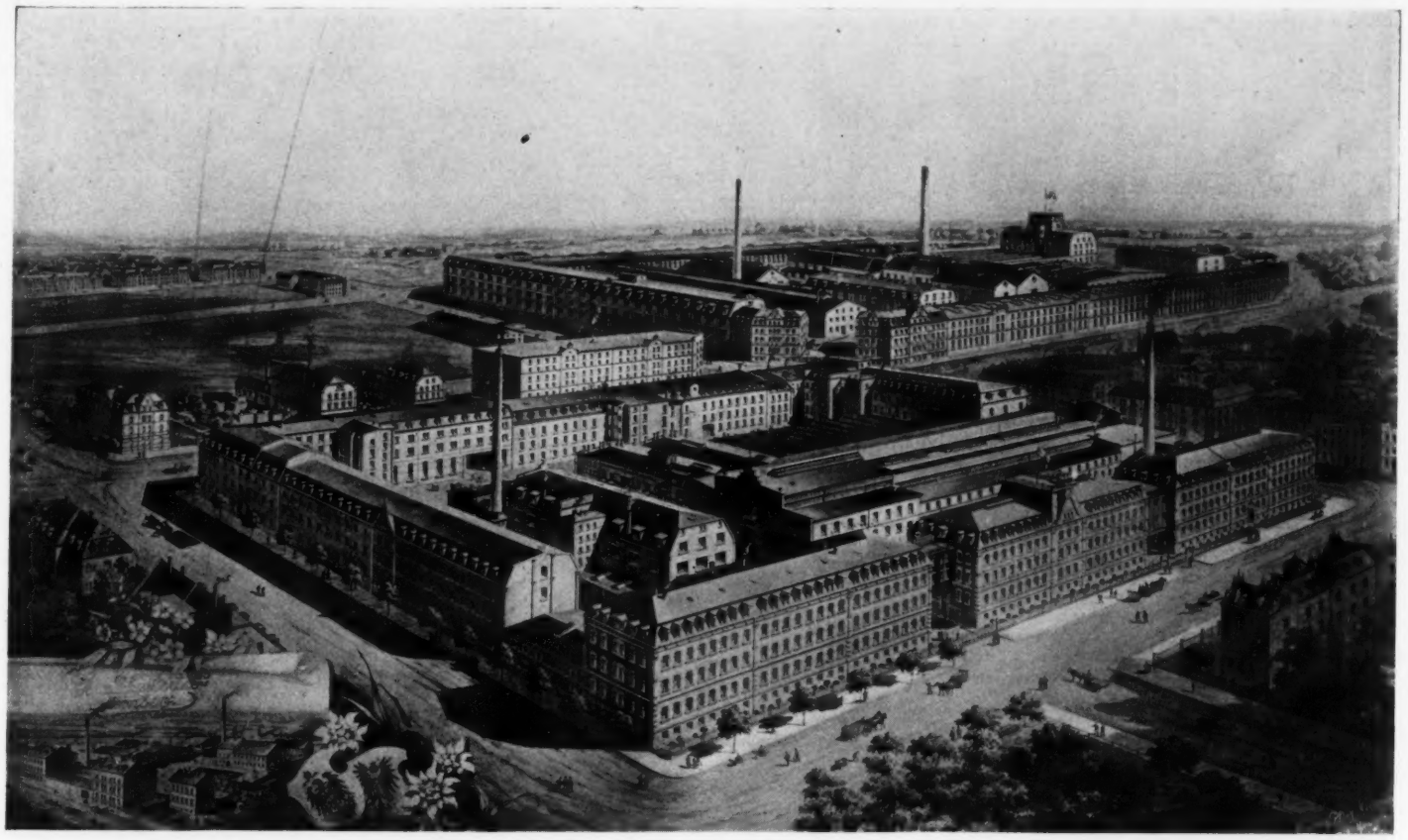


FIG. 1.—GENERAL VIEW OF THE SCHUCKERT WORKS, NÜREMBERG, GERMANY.

The benevolent enterprises which have been established by the company for the benefit of the Schuckert workmen constitute a very important feature in the management of the works, and are very beneficial both to the employees and to the firm. They are an Industrial School for the boys less than 14 years of age; a Technical School for boys 14 years old and older; a Domestic School for girls who have been confirmed, and a pension fund.

The Technical School is intended for such sons of Schuckert employees as may wish to learn instrument making or machine construction of various kinds. The school comprises two branches. In one theoretical instruction is given and in the other practical. The literary and theoretical branches taught include modern languages, history, geography, mathematics, physiology, physics, mechanics, chemistry, electrotechnics and drawing. Three hours each day are given by each student to these branches, and Mr. Soyter, who has been connected with industrial school work in Baltimore for five years, has charge of them. The second branch of the school under the direction of Mr. Kuhne teaches the practical mechanical branches as applied to the various trades. Every boy in these courses is required to spend some seven hours each day, six days a week, in the

shops, in addition to the three hours a day spent in the theoretical work. He begins with the simplest kind of shop work, filing, etc., and proceeds rapidly through each grade of work in his own particular chosen trade, so that in less than two years he is able to do very creditable work in his line as a mechanic. The writer has seen very good screw-gauges, micrometer calipers, electrometers, machine drills, and many other instruments made by the young instrument makers who were just beginning their third year. All branches of mechanical work are done here—carpenter work, pattern-making, forging, casting, lathe work and precision work of all kinds—and always done from drawings if possible.

The work is continuous through all the stages until the machines or instruments are finished ready for market. Many of the tools for the Schuckert works are made by these apprentices; and many models of the large machines, dynamos, motors, switchboards, meters, etc., of every type, are also made here for the use of the company for commercial purposes. The students also manufacture many things for market, such as calipers, watchmaker's lathes, telephone apparatus, automatic fire alarms and the like, and a specialty is made of electric clocks of many types and kinds. Thus the student or apprentice in addition to obtaining a good theoretical training, receives also a practical drill such as he could scarcely expect from a regular technical school.

This course lasts for four years. It costs the parents of the student nothing, while on the other hand the student may receive pay for his work. During the first year it is not customary to pay the students anything, except that a few of the very best may be granted a mere trifle each week as a prize to encourage greater effort. During the second year all are paid a little usually. During the third and fourth year all are paid wages regularly, varying in amount according to their skill.

Before they have finished their fourth year, however, many of the apprentices have been transferred to the regular Schuckert works, where they obtain permanent employment. Many of the foremen and heads of departments in the Schuckert factories are men who have been trained in this way. When a student has completed this course, if he has shown special skill and inclination in a certain direction, he can pursue his studies in the higher schools and state institutions to any extent that he may desire.

According to the caste conditions existing in Germany, a boy is quite certain to have the same kind of occupation that his father has had, or one similar to it. If, for example, the father is a machinist, the boy also is quite sure to be a machinist, or tool maker, or to have an occupation which is quite similar to that of his father. It therefore follows that the education and training of nearly all the sons of Schuckert workmen are provided for by these schools, and that without expense. More than that, the boys who have thus been specially trained for their particular trades become very desirable workmen and are quite sure to find employment with the Schuckert people. Thus this school system is mutually beneficial for both firm and workmen. It enables the firm to find suitable help when needed and, while preparing the young men for their life work, furnishes for them a market for their skill.

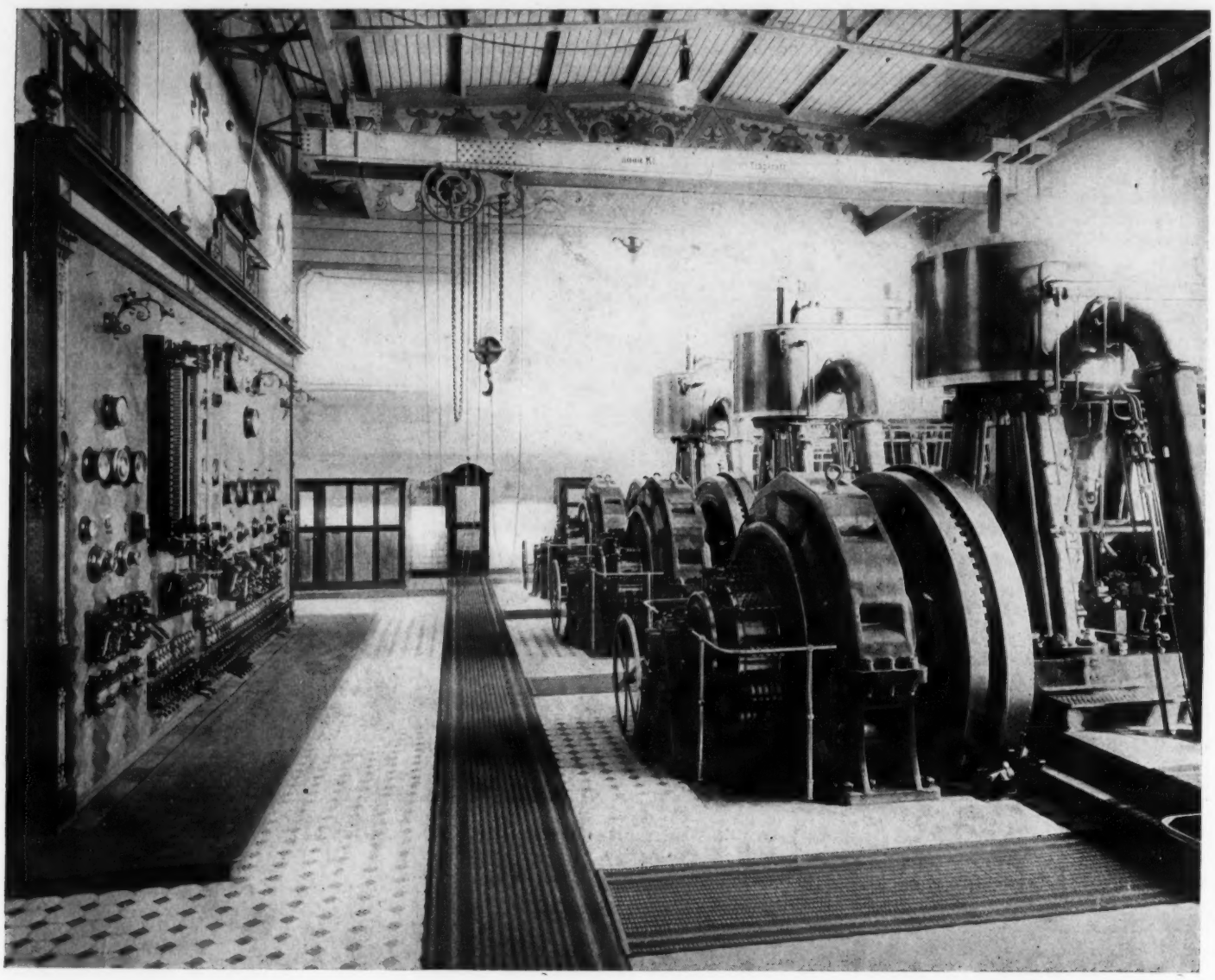


FIG. 3.—DIRECT-CURRENT GENERATING ROOM.

The daughters of the Schuckert employees are provided for by the Domestic School. All girls who have been confirmed, that is all the girls who have reached fourteen years of age, are here taught cooking, sewing, washing and ironing, dressmaking and all the domestic arts.

The schools are self-supporting to quite an extent. They are also provided for by an endowment left by Mr. Schuckert. If there should be a small deficiency, it is met by an insignificant assessment among the men.

From these funds pensions are granted to the disabled and aged and also to widows and orphans.

There is also a building society which has been organized among the workmen to enable them to obtain cheaper and better homes. This has been promoted and supported in many ways by the firm.

The pension funds were organized in 1896. There is one fund for the wage-earners and another for the salaried men of the firm. The method adopted is to build blocks three stories high, each block containing eight dwellings. Fifty such houses have been built and occupied and many others are in progress. There is also a co-operative store, for the exclusive benefit of the workmen, where they may trade or not as they please.

The best idea of the appearance and general arrangement of the New Works that is possible without a lengthy description being given, will be obtained from the general view of the works shown in Fig. 1, together with the ground plan, Fig. 2. The New Works occupy a total ground area of about 25 acres, half of which is covered by the new buildings. The company during the present period of business depression employs 5,000 people, but during the busy seasons it employs 7,000 or more.

All the various electrical appliances which are usually manufactured by electrical companies, are manufactured here, with the exception of electrical conductors and incandescent lamps. On passing hastily through the various buildings it is interesting to notice how much American machinery is employed. In every department American and German machinery may be seen running side by side, but there does not appear to be any English machinery used. The common testimony of the workmen who operate these machines is that they like the American machinery better than the German, and the reasons usually given are that the American machines are more convenient, more sensitive to adjustment, and that they do better work. The machinery here as a rule is run much slower than in American manufactories.

There are several "power halls." The one for direct current has three shunt-wound dynamos, each with an output of 2,700 amp. at 110 volts, and one shunt-wound dynamo with an output of 1,300 amp at 110 volts, each being connected directly with a vertical triple-expansion engine of 450 to 500 hp. There is also a booster unit, consisting of a continuous-current motor for 110 volts connected with a shunt-wound dynamo of 800 amp. at from 10 to 40 volts. For use in connection with these there are two storage batteries, one of 62 cells with a capacity of 4,536 amp-hours, and a charging and discharging current of 1,512 amp.; and the other a battery of 77 cells with a capacity of 740 amp-hours, and 430 amp. maximum current.

Among the many objects of interest to be seen in the works are a single-phase transformer made for 78 volts in the primary and 100,000 volts in the secondary; three-phase generators of 3,600 kw at 5,500 volts, and three-phase continuous-current transformer sets, consisting of a three-phase synchronous motor of 1,403 hp, mounted on the same shaft and bedplate with a shunt-wound dynamo of 520 volts and 1,540 amp.

FIG. 4.—WORKSHOP FOR LARGE ALTERNATING-CURRENT MACHINES AND TRANSFORMERS.

The company also manufactures an isolated lighting plant for such homes, hotels, etc., as may desire electric light, but which cannot obtain it from a central lighting station. The plant consists of a 5-hp gasoline engine mounted with a 24-volt dynamo, which charges 12 large storage cells. For incandescent lighting, since the cost of wiring is small, the more efficient low-voltage lamps are used. The dynamo, run by gas engine, charges the battery during the daytime and at night the lamps are lighted directly from the battery. Two types are manufactured, one for incandescent lighting capable of running seventy 24-volt lamps and the other capable of lighting four or more arc lamps.

Among the latest developments to be seen in the works is a three-phase current motor capable of running with four different speeds, 500, 750, 1,000 and 1,500 r.p.m., the changes in speed being effected

by merely manipulating a single controller. No resistance is introduced into the circuit to produce the speed changes. The armature is a simple "cage armature" and the invention lies entirely in the construction and winding of the field magnets.

Another new type is a three-phase crane motor, which has the casing of a three-phase induction motor and a continuous-current slot armature. This armature is provided with three lead wires at equal distances apart on its periphery, each of which connects to a slip ring. The motor, with load, is started with three-phase currents as an induction motor with phase armature. After having reached the normal speed, the rings are automatically short-circuited and the armature works as a short-circuit "cage armature." For brake work, as for example the lowering of a heavy weight, the continuous-current commutator is short-circuited over the starting resistance to a pair of field coils. The armature then works like the armature of a continuous-current dynamo, starting with the residual magnetism of the fields; it thus works like a short-circuited tramway motor in brake position.

It is, of course, known that the Schuckert Company supplies the world with parabolic glass mirrors for searchlight work. They therefore make a great specialty of searchlights and have produced the largest projectors in the world. The great one in the Sandy Hook lighthouse is a Schuckert searchlight, but one at the works

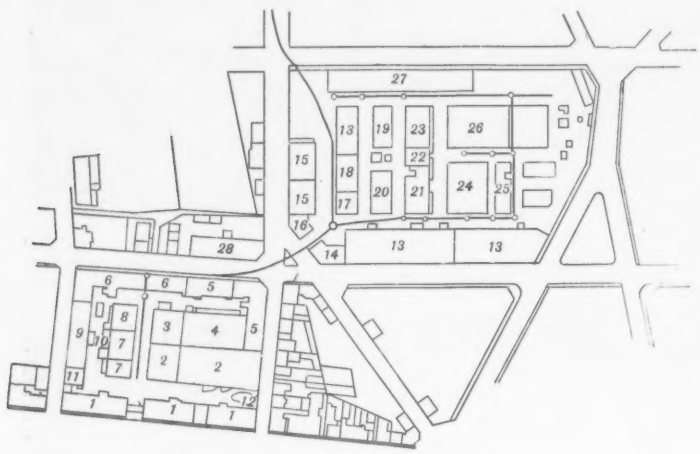


FIG. 2.—GROUND PLAN OF SCHUCKERT BUILDINGS.

No. 1. Administration Buildings.
No. 2. Direct Current Machinery.
No. 3. Central Power Hall.
No. 4. Machine Shops.
No. 5. Meters and other Instruments.
No. 6. Armature Winding.
No. 7. Packing Rooms.
No. 8. Boiler Rooms.
No. 9. Switchboards, Volt and Ammeters.
No. 10. Arc Lamps.
No. 11. Transformer Testing Rooms.
No. 12. Testing Rooms for large Dynamos.
No. 13. Alternating Current Machines.
No. 14. Laboratory, Chemical and Electric.
No. 15. Street Railway Machines.
No. 16. Engineer's Office.
No. 17. Testing Room for Special Apparatus, New Models, etc.
No. 18. Foundry, Iron, Brass and Copper.
No. 19. Forging Shop.
No. 20. Annealing Furnaces.
No. 21. Alternating Current Testing Rooms.
No. 22. Central Power Hall for Alternating Current.
No. 23. Boiler House.
No. 24. Carpenter Shop.
No. 25. Pattern Makers' Shop.
No. 26. Search Light Works.
No. 27. Work Shops.
No. 28. Store House.

is still larger and is said to be the largest ever made. The diameter of the mirror is over six and a half feet, while the power of the light is rated at 319,000,000 candles.

A very perfect electric typesetting machine for setting up printers' type is manufactured here. By means of this machine the manuscript to be printed is first typewritten and spaced as by means of an ordinary Remington typewriter; at the same time a record is made on a paper band or ribbon similar to that used on the Morse telegraph instrument. This record is then placed upon the type-forming machine, and when the latter is set into operation, it casts new type from molten type metal as they are needed, cuts them to the proper size, places them consecutively in line, regularly forming the words and spaces, and carries them forward line by line to the compositor's table, so that when the type reach the hands of the compositor they are in regular position ready for the press, it

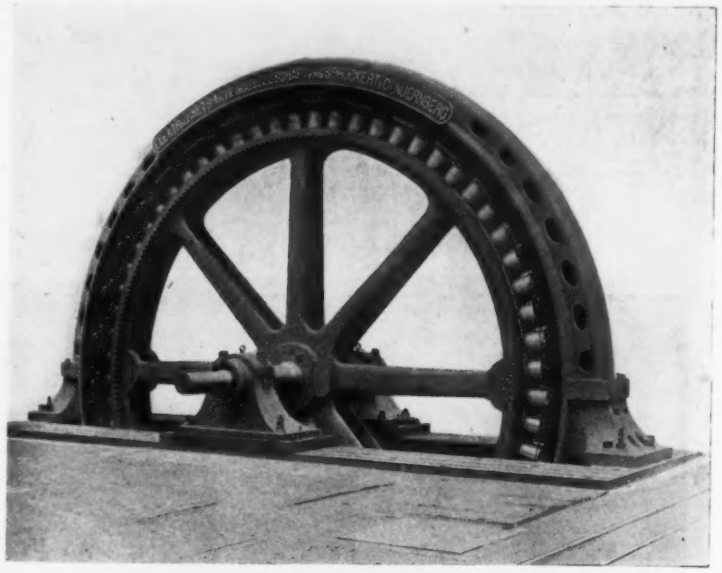


FIG. 5.—THREE-PHASE, 3,600-KW, 5,500-VOLT, SCHUCKERT GENERATOR, 96 PERIODS AND 94 R.P.M.

being then only necessary to "lock" the matter and to place the columns in position. This work is all done automatically and at the rate of 90 letters per minute.

A novel model electric railway also is to be seen at the works, which requires no trolley and no conduit. The rails are charged negatively, and there are insulated studs in the middle of the track for the positive charge, but these studs are never charged except as the car passes over them.

Production of Platinum in 1902.

The report for 1902 to the United States Geological Survey on the production of platinum in 1902, now in press, is in two parts, the first being the report proper, by Dr. Joseph Struthers, and the second a paper by Prof. J. F. Kemp on platinum in the Rambler mine, Wyoming.

The production of platinum from domestic ores in the United States decreased from 1,408 ounces, valued at $27,526, in 1901—the largest output recorded by the Geological Survey since 1880—to 94 ounces valued at $1,814, the smallest production since 1893. In connection with the platinum there were also obtained from the ores 20 fine ounces of iridium, as against 253 ounces in 1901. The domestic supply of platinum in recent years has been obtained as a secondary product chiefly from gold placer deposits in Trinity and Shasta Counties, California. It is reported that the metal occurs, though not in commercially rich deposits, in many other gold placers of California, as well as in Washington, Oregon, Idaho, Montana, Colorado and Alaska. The Rambler Mine, Wyoming, continues to attract attention, and during the year a considerable quantity of the metal was collected, but not marketed, by the Waratah Minerals Company at Kerby, near Grants Pass, Josephine County, Oregon.

The Russian sources of platinum supply, which furnish about 90 per cent. of the total consumption of the world, are comparatively limited. The platinum-bearing ores extend along the eastern watershed of the Ural Mountains in Eastern Perm and along the watershed farther south. The imports of platinum into the United States during 1902 were valued at $1.987,980, as compared with $1,695,895 in 1901.

Prof. Kemp's paper contains a brief description of the situation, topography and geology of the Rambler Mine, which is in Albany County, Wyoming, about 45 miles southwest of Laramie, near the headwaters of Douglas Creek, in the Medicine Bow Mountains; a description of the Rambler dike and an account of the ore body itself. Great interest was excited late in 1901 and early in 1902 by the finding of the platinum group of metals in the copper ore of the mine and by the separation from the ore of sperrylite, diarsenide of platinum. The metal has not yet been extracted on the commercial scale.

The Lodge-Muirhead System of Wireless Telegraphy.

BY A. FREDERICK COLLINS.

IT is extremely gratifying to learn that Sir Oliver Lodge has at last made public the practical results of his investigations in wireless telegraphy—extending over a period of several years—and that, in collaboration with Dr. Alexander Muirhead, a new system embodying many novel features is now to be placed on the market.

The experimental stations employed in testing out the Lodge-Muirhead system were located at the works of Muirhead & Co., Elmers End, Beckenham, Kent, and at Downe, a village 8½ miles distant respectively. Between these two points the geological formation consists largely of Kentish chalk, which, it is estimated, offers five times the resistance to the propagation of electric waves encountered over salt water, so that all things considered, the effectual range was equivalent to 44 miles.

The results attained were so satisfactory that an agreement was entered into with the Eastern Extension Telegraph Company whereby the latter two cable ships, the *Patrol* and the *Restorer,* were equipped with the Lodge-Muirhead apparatus, while they were lying off Gravesend, and just before their departure for the Far East where they were destined to lay a cable for the Dutch Government.

Again the system was made the subject of especially severe trials between ship and shore, a land station having been erected near

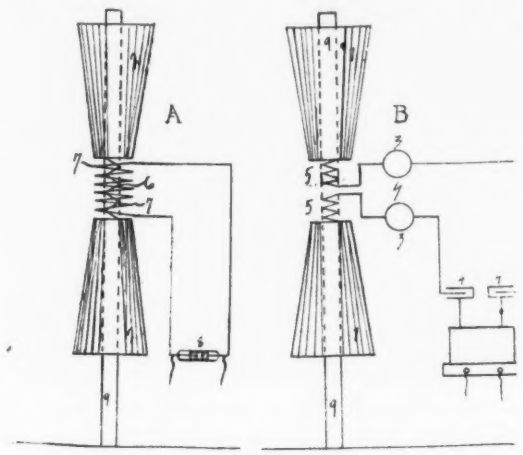


FIG. 1.—LODGE TUNED WIRE. *A*, RECEIVER. *B*, TRANSMITTER.

Holyhead and its complementary apparatus installed on a steamer of the Johnston line; then following the successful conclusion of these tests, Portsmouth and Portland were put into communication, the instruments operating splendidly over this range of 62 miles.

The transmission of wireless messages to a much greater distance is, of course, perfectly feasible, depending among other factors, on an increased initial e.m.f. and a greater elevation of the antennæ, but the inventors have not striven for longer range, as the desirability has not been shown to be of much importance, but what is needed is a system embodying speed and absolute accuracy, and to this end Messrs. Lodge and Muirhead have bended their energies.

Simplicity is another factor that enters largely into the make-up of a successful wireless telegraph, and this point has not been overlooked, since, practically, the receiver of the new system comprises only Sir Oliver Lodge's new coherer and Dr. Muirhead's improved syphon recorder. This combination marks an advance in the art of wireless telegraphy long sought for, i. e., the elimination of the relay and the decohering device or tapper usually employed in recording wireless apparatus.

Both the relay and the tapper for this purpose have a time constant that is far from low and this, together, with the excessively high time constant of the register, is the cause of the low speed limitations of Morse registering receivers. Oppositely disposed to these conditions, the Lodge coherer and Muirhead syphon recorder operate in unison and without the interposition of these extra appliances.

These are features of the new English system introduced and applied to the fundamental principles of syntonic wireless telegraphy already patented by Sir Oliver Lodge in 1897, and which marked the first attempt at selective signaling by properly proportioning the dimensions of the radiator and resonator and gives to the new company absolutely the sole rights on this method of construction.

It will be remembered that in Sir Oliver Lodge's first patent, No. 11,575, the transmitter comprised an oscillator circuit formed of two capacity areas and an inductance coil, and that the resonator circuit was of the compound type, having an open and closed circuit operating through a small transformer. The capacity areas which were made of copper cones with their apexes joined by the inductance coil were suspended and insulated in free air; these acted like the coatings of a gigantic air condenser; in the oscillator the inductance coil was divided into two parts, the terminal of the sub-divided coil joining the capacity areas whilst the other terminal was connected to one side of the spark-gap and the opposite side of the system to the complementary side of the gap, as shown in *A*, Fig. 1; both the capacity areas, with their respective inductance coils, were, however, separated from the spark-gap by adjustable condensers, so that any value of capacity might be obtained at the pleasure of the operator. The object of this arrangement was to prolong the oscillations in both the radiator and the resonator, and by a proper adjustment of the coefficients of these circuits produce any desired frequency of oscillation and, therefore, any length of wave to which the resonator would respond in consequence.

In this specific patent, granted to Sir Oliver Lodge in 1897, the idea of producing waves of a definite length, the cumulative effect of which would finally set up similar oscillations in the resonator to those surging in the radiator, and so indicate the transmitted impulses in a suitable receiver was clearly set forth and for the first time syntonic wireless telegraphy was based upon electrical resonance.

This system of selectivity devised by Sir Oliver was the outcome of a series of classical experiments based upon his syntonic Leyden jars in which one jar is caused to discharge through a circuit by the sparks of another jar, provided the two circuits are of equal electrical dimensions.

In the Lodge-Muirhead commercial system the tuning of the circuits is accomplished by adjustable capacities and variable inductances, which I have described in prior issues of the ELECTRICAL WORLD AND ENGINEER. The transformer used in the resonator system, or "jigger," as it has been termed in "English as she is spoke," is original with Principal Lodge. It is merely a high-potential transformer made of a very few turns of heavy wire for the primary, which also serves as an inductance, connecting the capacity areas of the resonator system, as shown in *B*, Fig. 1, and a greater number of turns of finer wire in the secondary, which is connected to the coherer; this transformer is without a core, as this would retard and tend to damp out currents of such enormous frequencies as are employed for signaling without wires.

This transforming device serves to effect an electrical connection between the open-circuit resonator and the local primary circuit, thus permitting the difference of potential between the upper strata of air at the top of the antennæ and that of the earth—always the cause of strays or "X's" in simple resonators—to equalize without giving rise to oscillations in the closed circuit, and therefore preventing false indications being registered on the tape.

Occasionally we find it stated that the transformer is necessary for long-distance work, but this is evidently misleading and fallacious. It is true that the reception of messages is more accurate when the device is used, but as the losses in transformation of low-potential, high-frequency currents are considerably greater than with low-potential, low-frequency currents; therefore, a greater amount of initial energy is required in transmitting a given distance where a transformer is used.

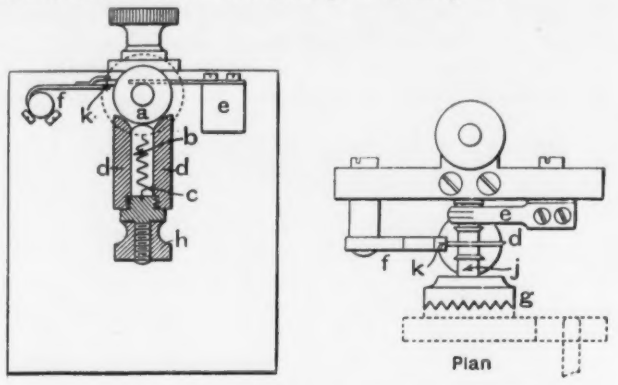
A higher potential may, of course, be obtained in the closed circuit connected with the terminals of the secondary, but it is obtained at the expense of current, resonance effects notwithstanding, and an electric oscillation to be effective in breaking down the resistance of a wave detector of the coherer type must have current as well as potential.

Two forms of oscillator systems are now employed in the Lodge-Muirhead equipment, and both are modifications of Dr. Lodge's original patent on wireless telegraphy. Referring to Fig. 2, *A* represents the most efficient type; it consists of a spark-gap, *s*, connected in series with the antenna, *a*, and having a condenser interposed at x_1; the opposite arm includes the inductance coil, *i*, a condenser, *x*, and grounded terminal, *E;* this system may be supplied with energy by means of the ordinary induction coil, with an interrupter, or the condensers may be formed of Leyden jars, and these charged by the secondary current of a commercial transformer—when they will discharge through the spark-gap, *s*. The compound oscillator system, *B*, Fig. 2, is made up of both an open

circuit and a closed circuit; the antenna, *a*, being connected with the earth through the primary coil of a high-frequency, high-potential oil transformer and a condenser, x_1; the secondary coil forms a closed circuit in which is included a pair of oppositely disposed condensers and the primary of either an ordinary induction coil or a transformer operated by a commercial alternating current; the oscillator spheres are in shunt with the closed circuit.

In the resonator system and receiving circuits of the Lodge-Muirhead apparatus lies the ingenious application of some absolutely novel principles. Here again the equipment takes on a modified form of that described in Lodge's first patent on wireless. The open resonator circuit is composed of the antenna, *a*, primary of a transformer, *t p*, which also serves as an inductance—condensers, *X* and *X*1, the latter leading to the earth as shown in the diagram, Fig. 2, *A;* the secondary of the transformer is in series with the new Lodge rotating coherer, *c*, forming a closed circuit, which includes the cell and recording instrument, *r;* in shunt with this circuit is a condenser, *X*2, the application of which was described in a patent issued to Lodge-Muirhead in 1897, and numbered 18,644; in this patent it is stated that a condenser in shunt with the recorder permits the oscillations set up by the waves to surge through the closed circuit-resonator with a predetermined and definite time period until it reaches its maximum amplitude and excludes these oscillations from the register and cell in consequence. This is claimed as one of the strong features of the new system and formed the basis of another patent issued to Lodge and Muirhead, and numbered 29,069.

A second modification of the system is drawn in diagram *B*, Fig. 2; in this case the antenna, *a*, leading to the earth through two



FIGS. 4 AND 5.—SECTION AND PLAN OF COHERER.

having a variability ranging from maximum resistivity to maximum conductivity equal to a filings coherer, but without the disturbing element of mechanical decohesion of the latter, has been a desiratum of inventors ever since the discovery of Branley.

The unreliability of the filings coherer has long been a source of annoyance to operators, for under certain atmospheric conditions it is often impossible to obtain indications at all. This is largely due to the variability of stroke of the tapper on the coherer tube and the changeability of position of the filings, which are as varied as the designs of a kaleidoscope; in some instances the filings are arranged so that they would respond to the feeblest impulse, and upon the very next stroke the marvelous sensitiveness is destroyed and the tube become inoperative.

The new Lodge-Muirhead coherer eliminates all these untoward features by keeping freshly and uniformly exposed surfaces constantly in action for cohesion. This is done by causing a small steel disc to revolve continuously in contact with a column of mercury, between which is interposed a thin film of oil; in action the coherer operates as follows: When the impinging waves set up oscillations in the resonator circuit the potential difference due to their cumulative effect disrupts the film of oil and at that instant cohesion takes place between the molecules of the solid and the fluid metals, only to be instantly restored by a partial revolution of the disc when

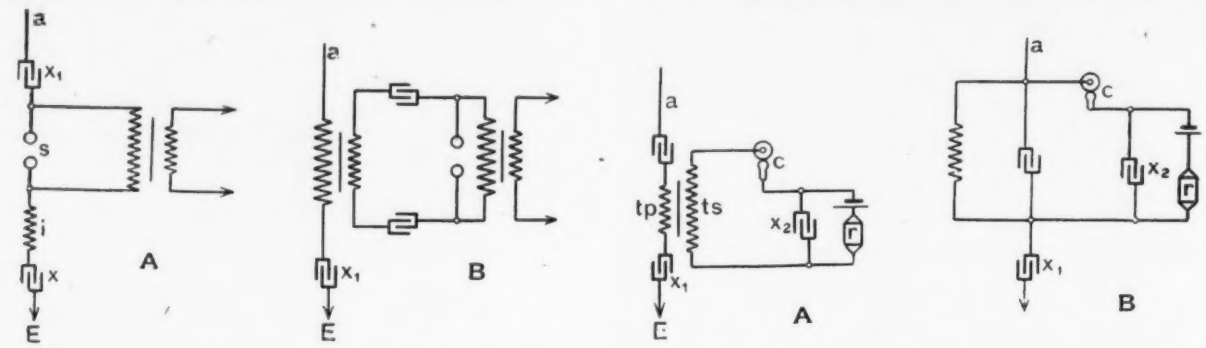


FIG. 2.—SIMPLE OSCILLATOR SYSTEM. COMPOUND OSCILLATOR SYSTEM. COMPOUND RESONATOR SYSTEM. SIMPLE RESONATOR SYSTEM.

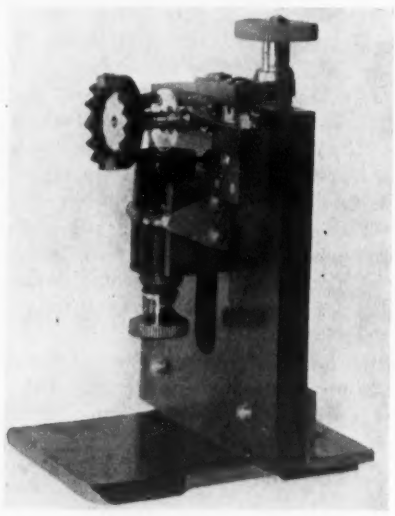


FIG. 3.—LODGE ROTATING MERCURIAL COHERER.

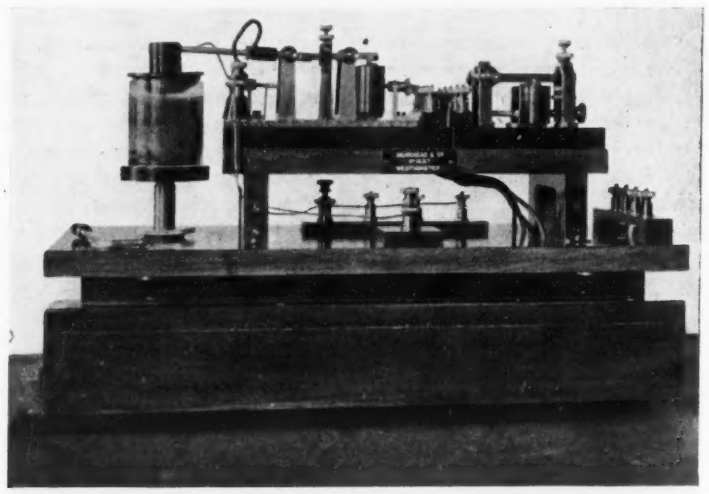


FIG. 6.—LODGE-MUIRHEAD "BUZZER."

condensers, and having an inductance in shunt on one side and a circuit in shunt on the opposite side, including a coherer, condenser, cell and recorder, as in *A*. In this patent one of the claims covers a metal case, which completely encloses the coherer, and this has been taken advantage of in the present commercial system now on the market.

The new coherer of Sir Oliver Lodge is of absorbing interest to those who have watched the development of the art. To produce a wave detector, sensitive enough for long-distanc transmission, and

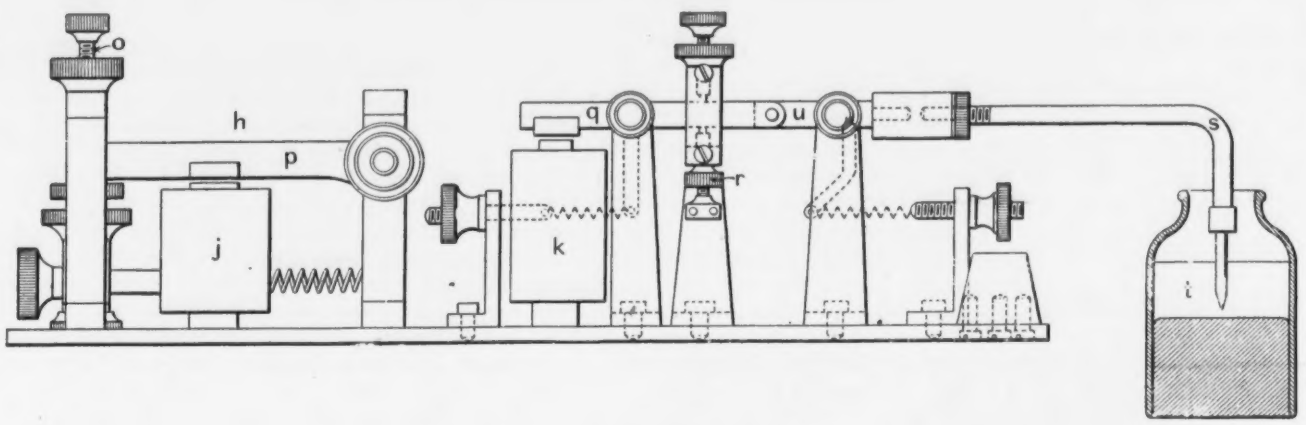


FIG. 7.—ELEVATION OF "BUZZER."

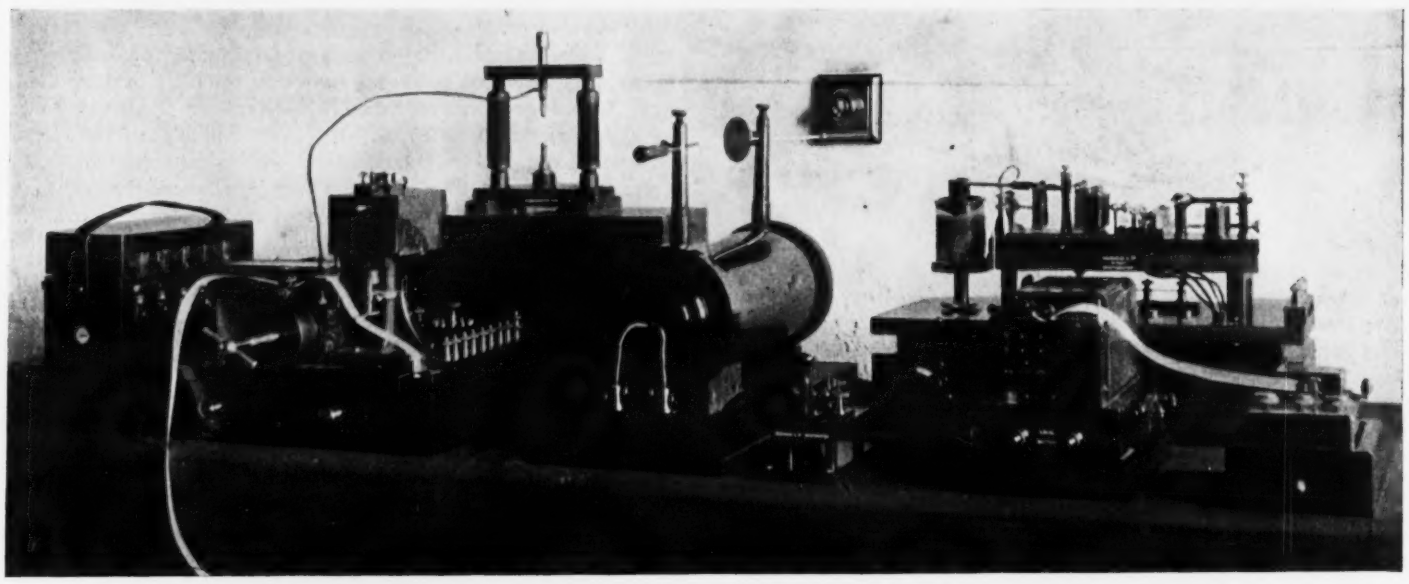


FIG. 8.—APPARATUS IN OPERATION.

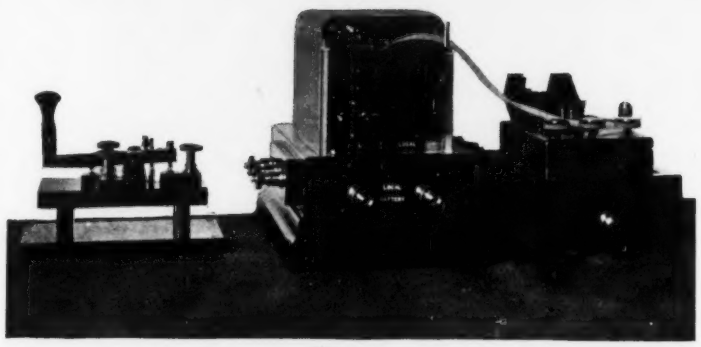


FIG. 9.—MORSE KEY, PERFORATOR AND AUTOMATIC MACHINE.

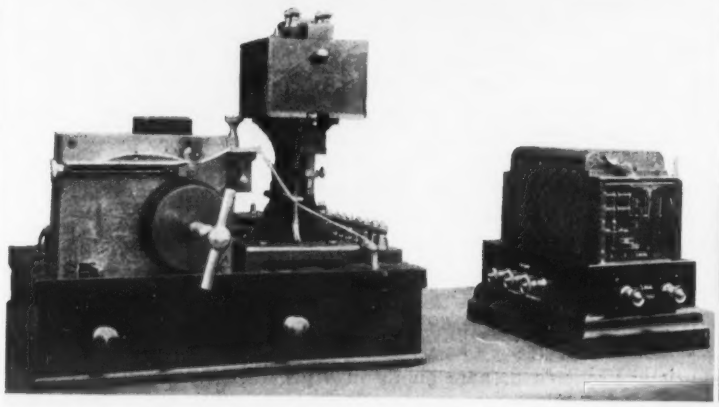


FIG. 10.—RECEIVING INSTRUMENT AND AUTOMATIC MACHINE.

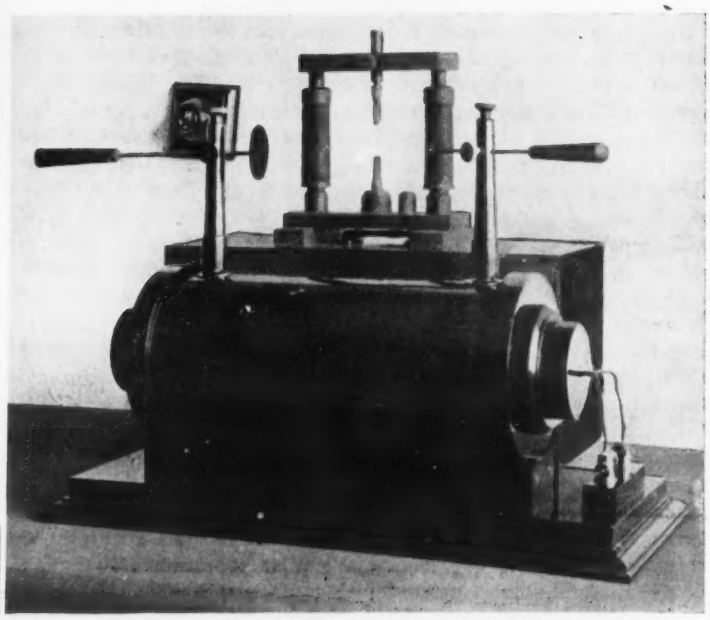


FIG. 11.—INDUCTION COIL WITH SPARK-GAP AND SYNTONIZING INDUCTANCES.

freshly-exposed surfaces are brought into position ready for the next impulse.

The coherer is shown photographically in Fig. 3, in sectional elevation, Fig. 4, and a plan view in Fig. 5. The rotating steel wheel is represented by *a*, the trough of mercury, *d d*, and an amalgamated platinum wire spiral, *b*, which is connected to the binding post, *h;* a copper brush, *e*, makes connection with the steel disc, *a*, through the axle, *j;* a spring, *f*, having a small piece of felt, *k*, attached, rests lightly on the disc, serving the purpose of keeping

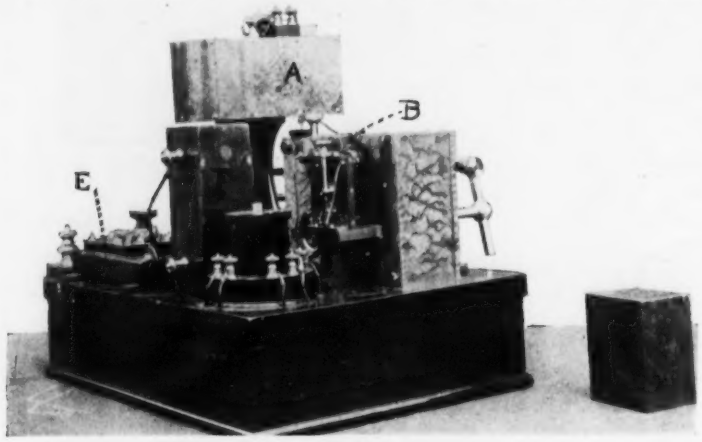


FIG. 12.—RECEIVING APPARATUS COMPLETE.

its surface dry and clean and avoiding foreign particles before and after cohesion.

The steel disc is revolved by ebonite wheels gearing into wheels of the same material, operated by clockwork, which also actuates the syphon recorder. The coherer is connected directly in circuit with the syphon recorder, but has interposed a millivolt meter for regulating the potential difference, which experience has shown should be kept from 0.03 to 0.5 volt, according to the adjustment of the instruments. This type of coherer is so exceedingly sensitive that a potential difference of 1 volt will break down the film of oil when cohesion takes place. A single cell is, therefore, employed in the local circuit and the excessive e.m.f. of this is reduced by the proper resistance. The revolving mercurial coherer of Lodge operates to a better advantage when the oscillations set up in the resonator are slowed down, and as such oscillatory currents are the result of long electric waves, and as these are more penetrating than shorter wave lengths, it is obvious that all these factors work to the end of producing highly satisfactory results. The feeblest oscillations will break down its resisting medium and give the desired indication; besides, this coherer is as absolute in its action as any other piece of electrical apparatus.

The transmitter includes a special device in the form of a Morse key and may be operated either by hand or by Dr. Muirhead's automatic signaling machine, in conjunction with a perforator. Whichever method is adopted, the local circuit includes a "buzzer," shown in the photograph, Fig. 6, and in elevation in Fig. 7; the purpose of this buzzer is to open and close the circuit in which the primary of the induction coil is included so that a definite frequency is obtained in the local circuit; this device consists of two sounders connected with each other so that they operate alternately. An arm of aluminum is fastened to a copper rod and connects with the armature lever of one of the sounders; the copper rod has a pointed end dipping into a cup of mercury and making or breaking contact, as the lever is drawn up or down. By this arrangement the current is interrupted about 600 times per minute and sets up a current in the secondary of the coil having a similar frequency. In action, when the Morse key is pressed into contact, the current is segregated, with the result that the disruptive discharge is broken up into a succession of sparks, and these may be of any duration the operator desires by merely adjusting the play of the levers of the sounders, and therefore the length of the dip in the mercury.

When the "buzzer" sets up low-frequency, high-potential currents in the secondary charging the oscillator system and oscillations surge through the radiator as a consequence, long electric waves are propagated through space at small but definite periods of time. When these reach the resonator of the receiver they actuate the coherer accordingly and are translated into the code of the operator by the syphon recorder.

The sensitiveness of the coherer is so great and the recorder works so thoroughly in unison with it that if the frequency of interruption in the "buzzer" of the transmitter is too low the received impulses on the tape show a wavy line, or if very slow a broken line, but when the frequency of the disruptive discharge is sufficiently rapid a straight line shows a steady deflection owing to the lag of the syphon.

The general arrangement of the apparatus in operation is shown in Fig. 8; it consists of a six-cell box of storage batteries, a complete receiving set, a spark rod frame, a 10-in. induction coil, a buzzer, a perforator, hand sending key, primary circuit switch, and an auto transmitter.

The Morse key, automatic machine and perforator are shown in Fig. 9, and the receiving instrument and automatic machine in Fig. 10; in Fig. 12 the receiving apparatus complete is illustrated in detail. *A* is the syphon recorder, *B* the recorder, *C* actuating mechanism, *D* reversing switch, *E* voltmeter, and *F* the transformer. Fig. 11 shows the 10-in. induction coil with special spark-gap joined by placing two metal points between two inductances for maintaining the proper relations with the capacity by the oscillator system. Fig. 13 is a sample of the tape when the buzzer was operating with a frequency equal to 600 alternations per minute.

When properly adjusted for sending a message the needle of the recorder is sustained so that if a dash is transmitted a long line is the result on the tape, whilst a dot is registered as a short line. While these recorded variations of the sparks sending out the waves are intensely interesting to the observer, the absolute adjustment to produce such accuracy is not of importance, for an operator can translate the recorded script, even though there are a number of impulses to each dash.

But as a matter of fact, its fine adjustment is not difficult, and when it is perfect the operator is enabled to determine even minute differences in the emitted wave by the fluctuations and peculiarities of the recorded impulses, and when these assume a serious aspect the cause may be easily and at once determined and rectified whether it occurs in the transmitter or the receiver. This is, of course, impossible where a relay and tapper are interposed in the local circuit; in this new feature lies one of the strongest points of the Lodge-Muirhead system.

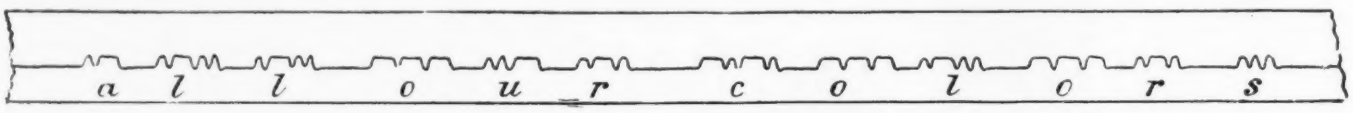


FIG. 13.—TAPE OF THE SYPHON RECORDER.

Industrial Education in Germany.

The great attention paid in Germany to scholastic industrial training is shown by the statement that in Saxony alone there are no less than 287 industrial schools, as follows: 120 advanced industrial schools, 150 special industrial schools, 321 industrial schools for drawing and painting, 21 industrial schools for women, girls and children; 441 industrial primary or continuation schools. The advanced industrial schools are of five classes, known as the industrial academy and architecture, machine construction, dyeing and industrial drawing departments. The industrial academy furnishes four courses—namely, for mechanics, chemists, architects and electricians. A requirement of admission is that the candidate shall have passed at least two years in a factory acquiring practical knowledge in the branch in which he desires to perfect himself theoretically. The special schools are divided among 21 branches of industry, such as watchmakers, brewers, etc., but electricity is not represented. The primary schools prepare pupils in a general way for some trade or particular branch of industry. There are 9 technical high schools now in Germany with 15,000 students, and two more will soon be opened. An applicant is required to have had nine years of training in the classical "real" school, or gymnasium.

The Milan-Gallarate Electric Railway.

BY P. LETHEULE.

ALTHOUGH the plans for the electric railway line between Milan and Gallarate, Italy, originally provided for a hydraulic plant on the Tessin River at Tornavento, it was later decided that a steam plant would be more economical, notwithstanding the high price of coal—$6—per ton. One reason perhaps is that the concession will expire in 1905, and the cost of a steam plant would be less than that required for water power development.

The accompanying map shows the railway system, which comprises one main and three sub-sections, with terminii at Gallarate, Porto Ceresio, Arona and Laveno, respectively. The generating plant is situated at Tornavento, as shown. The adjoining table gives data as to distances, elevation and grades.

Stations.	Distances in kilometers from Milan.	Height above sea level, metres.	Mean grades, per cent.	Maximum grades.
Milan	0	126		
			2.86	6
Gallarate	40.3	242		
			6.75	12
Tunnel d'Indumo	63.1	395		
			12.25	20
Porto-Ceresio	73	274		
Gallarate	40.3	242		
			2.81	8
Tunnel de Ronco	52.1	275		
			3.55	7
Laveno	71.5	206		
Gallarate	40.3	242		
			5.76	10
Pt. Culminant	47.7	284		
			4.66	11
Arona	66.2	198		

The running schedules on the lines are as follows: (1) On the trunk line from Milan to Gallarate, express trains are run without stops, but become ordinary trains on the branches of Porto-Ceresio, Laveno and Arona. (2) Semi-express trains between Milan and Gallarate, stopping only at Legnano and Bento. (3) Slow trains stopping at all stations between Milan and Gallarate.

FIG. 1.—MAP OF RAILWAY SYSTEM.

Local reasons, as above stated, have prevented the use of hydraulic machinery and the power is now produced by a steam plant, the situation of which would of course have been better if nearer to the line. The steam generating station, however, gives economical results as shown by figures presented below. Excellent running of machines in parallel is obtained, and the regularity of the service has made this installation one of the best in Italy. It includes three generating sets of 750 kw with steam engines of the Sulzer type built by Franco Tosi.

The alternators are three-phase, 13,200-volt, 25-cycle, direct-connected machines, running at 94 r.p.m. As in most installations of this character, the revolving field type of alternator is used. These machines do not differ in any respect but the size from those built by the same company (the General Electric Company of New York) or by the British Thomson-Houston Company for the Glasgow tramways and the Central London Railway.

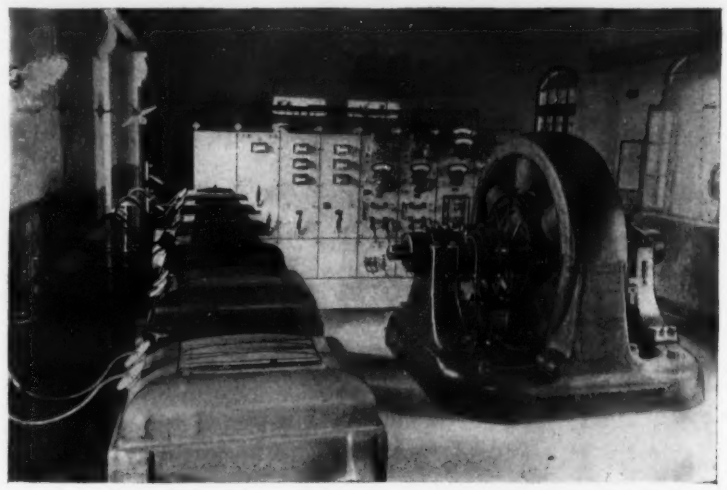


FIG. 2.—ONE OF THE CONVERTER STATIONS.

Two machines are in daily use running in parallel in summer time, one being sufficient for the winter traffic and the light traffic hours of the day. The service extends over 16 hours in the winter and 19 hours in the summer, and the running of the train service is exactly similar to that of a large trunk system of railway, with higher speeds, however, some trains running at exceptionally high speeds as will be seen later, and greater frequency of service.

The daily output of the generating station is 12,000 kw-hours in winter and over 18,000 during the summer, the average being 13,500 to 14,000 kw-hours. Momentary overloads of 75 and even 100 per cent. occur, and in summer the overloads jump to 2,000 or 2,200 kw, corresponding to 1,700 to 1,800 ihp per steam engine.

In spite of these unfavorable conditions, very economical results are obtained. In the last six months of 1902 3,800 tons of coal produced 2,500,000 kw-hours, and it is hoped still further to reduce this expense. The coal used is of good quality, costing $6 per ton. Good coal has been found to give the best results. In spite of the high price of coal in Italy and the disadvantages resulting from the choice of the station, the total expenses of the generating station during the last six months of 1902 did not exceed $31,800, corresponding to a price per kw-hour of 1.28 cents.

The generating station feeds 7 transformer stations by means of high-tension lines shown on the map. The line has given much satisfaction, only one interruption of service having taken place, this being due to a storm which broke an insulator and produced a short circuit at the switchboard, a few minutes sufficing to right matters.

These sub-stations are of the same type as is in general use on direct-current lines; that is, supplying 600 volts for traction, and current at 3,000 volts, three-phase, for distribution of power as in the case of the Glasgow tramways, London United tramways, Central London Railway, etc. There are seven sub-stations in all represented on the map, each containing two rotary-converters of 500 kw, three step-down transformers for feeding converters, one spare transformer, one reactance coil and one starting compensator.

There are, in addition, storage batteries of a capacity differing according to the service of the sub-stations, all but one having a capacity of 325 amp-hours, with a maximum discharge current of 600 amp; the remaining one, situated at Musocco, is of 500 amp-hours capacity, with a maximum discharge current of 1,000 amp.

The output of each of the sub-stations is 3,500 kw-hours, the maximum momentary overload attaining 1,000 kw in the case of Musocco sub-station. The working expenses of each sub-station, not including the storage battery, does not exceed $1,200 per year. The average efficiency is between 82 and 85 per cent.

At the commencement of operation, short circuits were frequent,

the workmen being unfamiliar with electric traction. Now, however, the circuit-breaker rarely acts more than once a day at each sub-station except on fête days.

The switchboard of the sub-station is built according to common practice, there being separate panels for the alternating and direct-current sides. Fig. 2 illustrates a sub-station with two converters,

FIG. 3.—PROTECTION OF THIRD RAIL.

the outside panels shown being the line panels. The direct-current line panel is provided with a recording wattmeter connected to the 600-volt third-rail system. The track is bonded and forms the negative side, the positive side being the third rail of the same type as the track rails supported every 13 ft. by insulators formed of "reconstructed granite." Tests made have given a figure of 0.064 ohm for the resistance of a kilometre of single track and third rail.

Wooden protection from the third rail is employed in stations, railway yards and level crossings, as shown in Fig. 3; these are independent of the track, a doubtful practice as the protection is thus liable to become displaced.

The third rail insulators at first proved defective by reason of the iron caps becoming loose on the insulator and the lead filling giving way under the voltage, causing short circuits and deposits on the insulator block. The lead filling has now been replaced by cement and the insulators give perfect satisfaction.

The average resistance of insulation is 60,000 ohms per insulator; the average loss per kilometre of single track, owing to imperfect insulation, does not exceed 0.1 amp. in dry weather and 0.2 in wet weather. The third rail collector shoes are of American pattern and supported from the journal box.

The rolling stock includes one electric locomotive for hauling freight trains, and twenty motor cars and twenty trailers for passenger trains. All motor cars and locomotives are equipped with direct-current motors of 160 hp, geared to the axles, the driving wheels having a diameter of 1.05 meter.

The weight of each motor with gear amounts to 2,500 kg. Series-parallel controllers of General Electric Company make are used with corresponding accessory apparatus in the motorman's cabin. The braking is done by compressed air obtained from an electrically-driven compressor.

Speeds have been attained of 56 and even 62 miles per hour. These high speeds have been easily obtained and have given rise to no inconveniences with respect to the gearing, current collection or bearings. The regular service is made at speeds varying from 35 to 45 miles per hour, with train weights of 75 to 90 tons. The maximum starting power per train is from 400 to 450 kw and 240 kw suffices to maintain a speed of 56 miles per hour on the level and 100 kw for a speed of 35 to 45 miles per hour on the level, the motors being coupled in series.

The express trains running from Milan to Gallarate make the journey in 34 minutes and the down trains in 33 minutes, including two slow-downs; this corresponds to a commercial speed of about 45 miles per hour.

Between Gallarate and Porto-Ceresio the speed is considerably diminished on account of the curves, but the whole distance between Milan and Porto Ceresio is made by express trains in 1¼ hours, corresponding to a schedule speed of 37 miles per hour. The average current consumption per ton-kilometre measured at the sub-stations is 50 watt-hours, which is lower than the guarantees of the contractors. Multiple-unit train control system has been experimented with and the Mediterranean Railroad Company will soon place a number of these equipments on the line.

The results of the operation have been perfectly satisfactory from all points of view. The results obtained have exceeded all hopes, and the railway company bears witness to this in its last annual report. The increase in traffic has been remarkable as the following figures will show:

During the first year of electric service the electric trains covered 11,000,000 kilometers, whereas the last year of steam service only effected 4,769,000 kilomtres. With the latter the average train kilometre per day amounted to 580, whereas 3,712 are now daily made; that is, more than seven times as many.

In spite of a decrease of 50 per cent. in the fares charged, the receipts for the first nine months increased to 993,150 lire, whereas during the last year of steam service they only amounted to 663,000 during the same period. On a certain holiday the receipts amounted

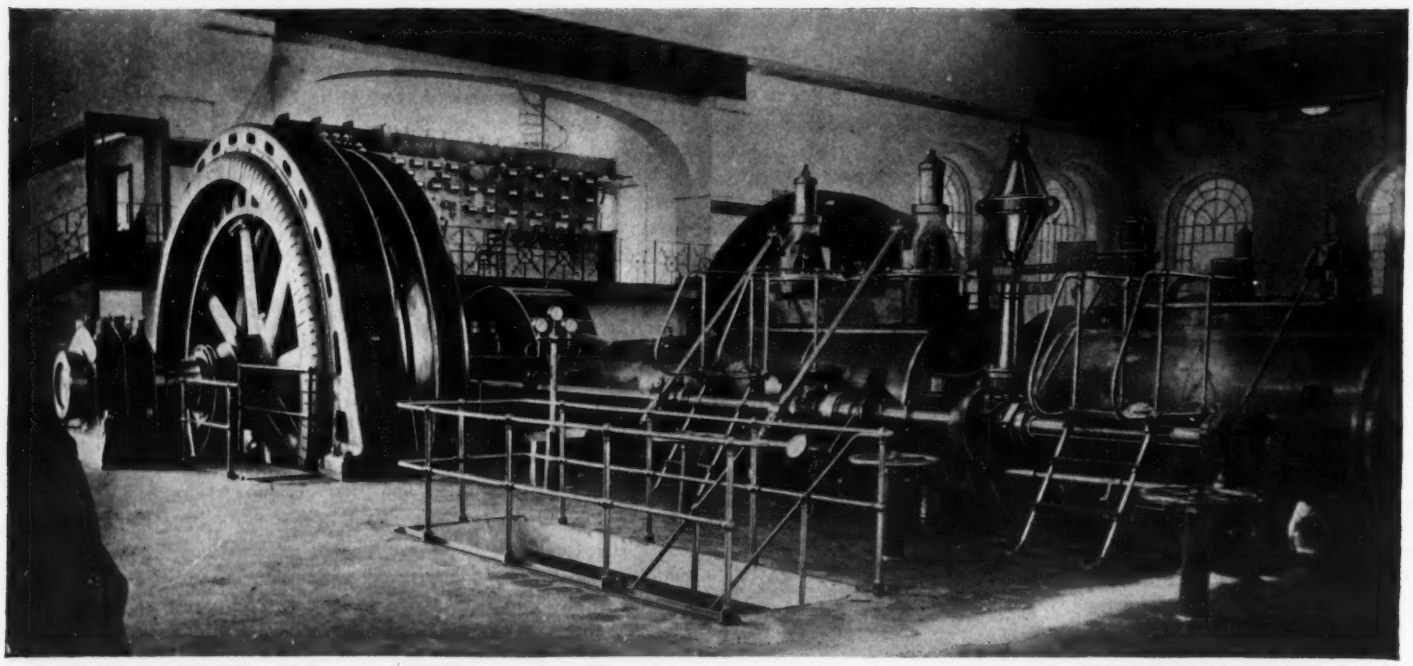


FIG. 4.—VIEW OF GENERATING STATION AT TORNAVENTO.

to 50,000 lire, against 22,900 lire for the last year of steam service for the same day. This represents four times the number of passengers, taking into account the decrease in fares.

The whole results prove incontestably that electric traction has been a very great success in connection with the working of this line. The whole electrical equipment was furnished by the Cie Francaise Thomson-Houston de la Mediterranée, the representative of the General Electric Company in Italy.

The Mechanical Cause of Gravity.

BY ROBERT STEVENSON, C. E.

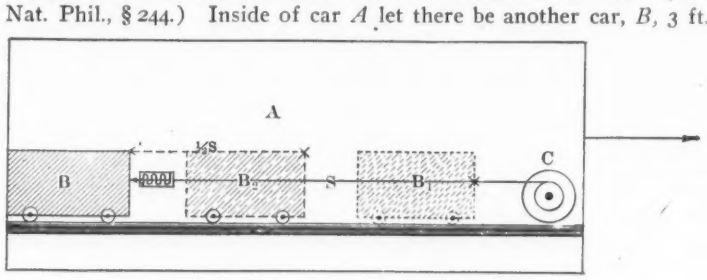
IN an article on May 26, an experimental method of producing orbital motion without the mutual attraction of matter was given.

On June 2 a letter appeared from Mr. T. Wolcott saying that he had tried the experiment by means of a water nozzle held in his hands, and although the apparent motion of the water was helicoidal, yet he believed the actual motion was not so; and gave his reasons. On June 9, in reply to Mr. Wolcott, I explained that his experiment was entirely different from the one given by me, because he held the straight nozzle in a radial position, whereas in my experiment the water and balls were projected tangentially to the circle of rotation. Furthermore, the water in his case could not have a velocity of 100 ft. per second, because he could not rotate a nozzle by hand with water jetting through it at that velocity. And it should be constantly remembered that the stability produced by the momentum of the mass is the proximate cause of the novel effect.

I satisfied myself years ago that the effect could not be got from garden nozzles in the way he tried. But curious to say when I ask scientists to test this experiment, they invariably do as Mr. Wolcott did, and then make up their minds that the apparent effect is an optical illusion. I further mentioned in the letter of June 9 that I was prepared to prove that Galileo and Newton in formulating the first principles and laws of motion had neglected to recognize the all-important fact that lineal momentum produced kinetic stability, and that stability supplied the force which Newton called centripetal force, and which he ascribed to the mutual attraction of matter; that component force is the cause of the helicoidal motion of balls or planets; that force changes the direction without doing work. That is, the force which Sir Oliver Lodge has been trying to make out to be a mental force. And he is really nearer the truth than he imagines, because kinetic stability is produced by the combined effort of power and intelligence. But as we are only dealing with the physical effect here, it is unnecessary to trace the psychological interaction.

In proof of the statements made in the letter of June 9, I had a series of articles ready to be published, but as they dealt with first principles it has been thought that they would not interest technical readers so much as the practical application of them would do. Consequently, I propose to print them in pamphlet form, and will be pleased to send them gratis to any readers who will forward their address to the editors. In the meantime, I will devote this article to one phase of the practical application of the principles, so as to show by a kinetic illustration how motion can produce weight and energy without attraction.

Let us suppose a car, *A*, 25 ft. long and 10 ft. wide and 10 ft. high, with mass, *M* (but no weight), moving through free space in a straight line in accordance with Newton's first law of motion. (See Nat. Phil., § 244.) Inside of car *A* let there be another car, *B*, 3 ft.



MECHANICAL CAUSE OF GRAVITY.

long, 2 ft. wide and 2 ft. high, whose mass is *m*, also having no weight. Let $M = n\,m$, where *n* is a very large number. At the front end of car *A* let a power hoist be fixed with a rope the full length of the car. At the rear end of car *A* let car *B* be at rest against the end partition, on a pair of rails which run all the length of car *A*. Then fix the rope to car *B*, and hoist it up towards the front end of car *A* with velocity *v*. A momentary impulse will supply all the force necessary to give it the uniform velocity, *v*, and momentum, $m\,v$. The amount of that impulse would be $m\,v/t = m\,a$. Now suppose we return car *B* to the rear again, and car *A* be given a uniform acceleration of 32 ft. per second. Now so long as this constant acceleration continues in the motion of car *A*, we can feel that car *B* is being pressed against the rear end of car *A* with the pressure $M\,g$, where $g = 32$.

Now that pressure is weight, exactly the same in quantity and quality as if *B* was on the surface of the earth. Now suppose a committee of philosophers were selected to investigate this pressure of *B* against the rear end of the car, and suppose there were no landmarks by which they could discover that *A* had acceleration. They having been born and brought up in the car. Let us call them Epicurus, Aristotle, Galileo, Newton, Boyle. Epicurus attempts to explain the cause of the pressure: First, he tugs at car *B*, and when he lets go it constantly falls back towards the partitions. After much experimenting and thinking, he gives his opinion that car *B* has a desire to rest against the partition, and that it takes a big effort to prevent it.

Aristotle said, Yes, there is an apparent desire, but the desire is due to everybody in the universe having a right place to which it belongs naturally, and it can only be prevented by an effort from getting there, and when once there it takes an effort to remove it, and when the effort stops it tends to go back to its right place. And, furthermore, he said that desire to get to its place increases with its density, and also with the shape of the body. That desire is its gravity.

For two thousand years that explanation of Aristotle was the orthodox doctrine of gravity, until Robert Boyle put the car, *B*, in a vacuum and kept reducing its density and found that it fell just as fast back to the partition when its substance was as light as down, as when it was gold; and that fact upset Aristotle's theory of gravity. But whilst Boyle was experimenting with his vacuum, Galileo was experimenting with the rate of fall. His idea was more scientific than philosophic. He wanted to find the law of the fall. He did not believe that the fall was due to desire; but whatever the cause might be was of very little consequence compared to the law of the fall; because the fall could not be utilized with certainty until the correct law of the motion and pressure was found.

The idea never seemed to enter Galileo's mind that the little car did not fall at all, but that it was the big car that was doing all the falling.

After Galileo came Newton, who accepted Galileo's laws of the fall of bodies, and never doubted but that the fall was genuine; and he also said that although it would be nice from a philosophic point of view to know why this car always tended to that partition, yet the law was of the greatest importance for mankind to know. He did not agree with Epicurus that it was by desire, but he thought a more appropriate term to use would be attraction. Then he demonstrated geometrically that the partition attracted the little car and the little car attracted the partition directly as the mass of the one multiplied into the mass of the other and inversely as the square of the distance between them, the formula being $g\,\frac{M\,m}{d^2}$, where *g* is the constant of gravitation, or as we have seen, the rate of acceleration of *A*. It might be asked what has *M* and *m* and *d* to do in the formula when the fall of the body depends entirely on *g*? But it must be remembered that although the rate of fall may be independent of the mass of a body, yet the force depends on the mass, $F = m\,g$; and although it is not *m* that is falling, yet it is the inertia of *m* which continually resists the constant impulse produced by the acceleration of car *A*; and the effect of that resistance is the pressure we call weight.

The car *B*, to begin with, had no weight, only mass, and now it has been converted into a weight, by a mode of motion; and that in spite of the orthodox theory, that weight could only be produced by the mutual attraction of the particles of matter in the partition and in the little car. There may be those who hope that I may be mistaken in my analysis, and that although it can be shown that weight is a mode of motion in this case, it may not apply to the case of bodies on the surface of the earth.

Now that the theory of attraction is shown to be untenable, let us investigate that most wonderful condition called energy. Energy

has been adored as the greatest discovery made by science since Newton discovered the mutual attraction of matter, and with matter it is said to be the one eternal condition in the universe. Consciousness and force may come and go like a bank rate, but energy goes on forever. And there are many great philosophers and scientists who really believe that mankind can never know more of the Creator than what is shown in these two attributes of the cosmos. In the figure let A represent the large car, and B, B_1, B_2, represent the small car in different positions. Let C represent the hoist, and the arrow the direction of motion of A. Let us suppose the little car, B (which we will call the body) is resting against the rear end partition of car A; and car A is being accelerated uniformly at the rate of 32 ft. per second $= g$. Then car B, or body, would press against the partition with the weight, $m\,g$, exactly the same as it would do on the surface of the earth. Let a rigid but weightless rope connected with the hoist have a spring balance next the hook, which attaches it to the car B, or body; and when the hoist relieves the partition of the pressure of B, the spring will indicate the pressure, $m\,g$, the same as it would do if B was suspended by the balance at the earth's surface.

Now, if the hoist gives B uniform motion towards B_2 at the rate of 16 ft. per second, $= v$, the power required would be $m\,g\,v = P$. And in time, t, the work done would be $m\,g\,v\,t = P\,t = f\,s$, where $s =$ 16 ft. But when the power stops working at distance S, the body, B, will not stop at once, but by reason of the impetus, $m\,v$, will be carried a further distance, $h = v^2/2g$; at which height the body appears to come to rest relative to car A, but not relative to the fixed co-ordinates in space. When dealing with two sets of co-ordinates, great care must be taken in specifying which set is referred to. I find that it was due to that want of care on the part of Galileo and Newton that they were deceived into the belief that appearances were realities, and whilst thinking they were superimposing momenta they were only superimposing velocities, and consequently they failed to find the true physical result. So long as the power, P, is moving the weight, $m\,g$, with the uniform velocity, v, there is a definite amount of work being done, $= m\,g\,v\,t = m\,g\,s$, where t and s are time and distance, respectively. But when the power stops, then the impetus of the body carries it a further distance, $v^2/2g$, before it appears to stop, when the kinetic energy is said to be converted into potential energy. And the whole work, $W_1 = m\,g\,(s + h) = m\,g\,s + {}^1/_2\,m\,v^2 = {}^3/_2\,m\,v^2$.

If we take a case where B is projected forward from the partition by an impulse, with an initial velocity of 32 ft. per sec. $= v$, then in one second $= t$, the distance traveled by B is $v^2/2g$, $= 16$ ft., the same distance as in the previous case that the power traveled in the same time with only half the initial velocity of this case; but in that case the velocity was uniform, whereas in this case there is a uniform retardation (apparently). Consequently, in this case the kinetic energy $= \frac{1}{2}\,m\,v^2$, the average velocity during this time being $\frac{1}{2}\,v$.

Now, when the body, B, comes to rest relative to the car A, all the kinetic energy of B has been said to be converted into potential energy, and then to appearances, B begins to fall of itself towards the partition at the rear end of A, with an accelerated velocity the same as bodies falling at the earth's surface. That is the phenomenon which is presented to the inhabitants of the car, who do not know that their car is being accelerated, and never dream that the apparent fall is due to that accelerated motion, but who believe with Galileo and Newton that the body actually falls, and that there must be some attractive influence in the rear end to produce that accelerated fall.

The formulæ in both cases are the same as that of falling bodies at the earth's surface, and in the pamphlet it will be proven that weight and energy are produced in the same way in both cases. The first law of motion will be subject only to the principle of *kinetic stability*, which is the only *new principle* to be established to take the place of attraction.

But in this change of principles we must not forget that kinetic stability produces an effect to all appearances the same as attraction, and consequently there will be little change in the integral resultants; although our ideas will change about the cause of a stone falling, yet that change in ideas will not alter the result. Whether it be the rate of fall, or the blow struck by the body when it reaches the earth, Galileo's and Newton's laws will still hold as before, only we will know the cause of those laws, which up till now had to be taken on faith. It is unnecessary to take up space analyzing the correlated motions of the two cars, as those readers who can follow the argument can do that for themselves, and so become convinced that B does not fall back, as it appears to do towards the rear end partition of car A. Consequently the mass of the partition cannot be the attracting cause of the apparent acceleration of B towards it.

The facts to be noted in this illustration are:

I. That the accelerated motion of car A induces weight on car B without attraction.

II. That to move that weight forward is like lifting a weight vertically upwards at the earth's surface, and it requires the same power.

III. To project B forward with an initial velocity requires power and work, and produces energy, the resultant being called the space integral of the force $= F\,S = {}^1/_2\,m\,v^2$.

IV. When the kinetic energy is transformed into potential energy, the true cause is the motion of A, not the attraction of its rear end, as taught at present.

V. The reversibility of the process is apparent, when we know that the velocity acquired by the car A in one second is equal to the initial velocity of B, when the two come to rest relative to each other in one second.

Suppose B be given an initial forward velocity, $v = 32$ ft. per sec., it would continue uniformly at that speed, but owing to A having an accelerated velocity of 32 ft. per second, then at the end of the first second both are moving with the same velocity in the same line and direction, and consequently are at rest relative to each other. But at the end of the next second, A has acquired a velocity equal to $2v$, whereas B is still moving with velocity v; consequently, the rear partition of A strikes B with $2v\text{-}v = v$ velocity, but the philosophers in the car think it is B that strikes the partition in the same way as Galileo thought it was the projectile that fell to the earth.

What I intend to prove in the article which I propose to print and distribute in pamphlet form, is:

First. That Galileo, in studying the laws of falling bodies, made the mistake which many might make in supposing the little car, B, to be the falling body in the large car just shown. The appearances would be the same and the laws the same, but the causes are different. The scientist might say, "What does it matter whether the train goes to the stations or the stations come to the train; the time table is the important knowledge." But if old George Stephenson could have made mankind believe that the stations came to the train, as Galileo and Newton have made them believe that the stone falls to the ground, then who would ever have thought of improving the locomotives. And so throughout the whole range of the arts and sciences, new inventions and improvements have followed rapidly the true knowledge of causation.

Second. Galileo and Newton made a serious mistake in supposing that a cannon ball at rest in a moving car when rolled across the moving car was having the two motions or momenta compounded on the ball, whereas the motions so apparently superimposed are relative to different sets of co-ordinates and consequently it is not a case of compounded momenta at all. It is just as much an illusion as that of the falling body. To compound momenta on a moving ball, both components must be measured relative to the same fixed co-ordinates, and for such motion there is no law at present.

Third. Galileo and Newton, in laying the foundations of dynamical science, failed to notice that a mass which has inertia and acquired that inertia through certain kinds of motion to which it has been subjected, almost in a similar way to that by which an electric charge acquires inertia by self-induction, as Oliver Heaviside has so clearly shown.

Fourth. Having failed to grasp the true cause of inertia, they also failed to discover the persistence of lineal momentum, which without doubt is the most important principle in the universe, as it applies to both physical and mental forces. This persistence of momentum increases with the momentum, and it is this principle which produces the stress on a fixed guide, or connection, when a body with its own momentum describes a curve without loss of motion, and produce the stress apparently from nothing and disappearing when the body describes the tangential straight line again. That persistence increases with the momentum, although Galileo's law of inertia endorsed by Newton denies the existence of such a principle.

Fifth. Without a knowledge of the persistence of momentum it was impossible to grasp the hidden key to the treasures of nature. This key I have called kinetic stability. Kinetic stability is simply the tendency of displaced momenta to return to their place, as was taught by Aristotle two thousand years ago. But of course it has a meaning and purpose grander and more profound than even the

wise old Stagyrite could appreciate; because it explains elasticity, gravity and all the other forces of nature whose causes are still ignorabimus to science. But the explanation, proof and application of this principle in its most rudimentary form will take up fifty pages of the pamphlet, and to that I must refer the reader.

Sixth. The parallelogram of forces when applied to free celestial motions is another fallacy, formulated and established by Galileo and Newton. But when applied to terrestrial mechanics is perfectly correct, when the components are compounded simultaneously, because then the problem is one of statics so far as the composition is concerned. The true resultant when two transverse component momenta are compounded relative to the same fixed co-ordinates, is a geodesic curve of least action, where $s \int v\,ds$ is a minimum. For the proof see the pamphlet.

Seventh. When a car is moving with uniform velocity, v, in a straight line in space, and a ball is at rest in the car, the ball having mass $= m$, and velocity v, the same as the car; its momentum $= mv$, relative to the co-ordinates by which the car's motion is measured. Now if that ball be given a velocity, v, backwards, and relative to the car, then its momentum relative to the car is $-mv$. Now Newton calls that compounding momenta in opposite directions, and he lays down the law, $mv - mv = 0$. (See Nat. Phil., § 252.) In this case we have two momenta which completely annihilate each other, masses and everything disappear, and nothing is left to show that they ever existed. However, when we more closely analyze the motions, we find there is no compounding of momenta, because the components were measured relative to different sets of co-ordinates. It is simply a case of two equal and opposite velocities equating each other, and the mass of the ball is left standing relative to the fixed co-ordinates in space. Had the ball been moving with the same speed, v, free and independent of the car, and it had been given an opposite velocity, v, without stopping its previous force, $mv/t = ma$. Then the power necessary to compound the two components would be mav, which is the true law, instead of that given as $mv - mv = 0$. The proof of this rule will be given in the pamphlet.

Having dealt with the laws of motion and shown that the Newtonian laws are only correct for terrestrial and apparent motions; that the most important motions in nature, celestial and molecular, are still without laws of a kinetic character, and have hitherto been only explained by the use of the mathematical metaphor which Newton called attraction, and the belief that bodies fall to the earth. We will then show how the true laws of motion explain the phenomena of the portions of the universe within our capacity to analyze and measure, thereby replacing the Newtonian system with one better suited to modern science, and more fruitful in its results, so far as the explanation of causes is concerned.

Rotary High-Frequency Interrupter.

BY M. EASTHAM.

INTERRUPTERS for high-frequency coils may be divided into two classes—stationary and rotary. The stationary interrupter has in its favor simplicity and cheapness. The rotary type gives a much steadier spark and needs practically no attention. Anyone who has operated a coil with the ordinary spark-gap knows that it keeps a person busy most of the time regulating it. A slight variation in voltage, or change in the position of the arc between the discharge balls or plates, changes the length and nature of the secondary spark. The rotary interrupter requires less condenser capacity than is needed by the other, repolishing is very rarely needed, and, as stated above, it gives a very even secondary discharge. In Röntgen ray work, a steady spark is absolutely necessary for good fluoroscopic examinations, and is desirable in radiography.

Rotary interrupters are almost always run by a motor, the induction motor being the most practical. The interrupter described here is an induction motor in itself, the copper disc which makes and breaks the circuit acting also as the rotor to this motor, the stator being a V-shaped electromagnet, which requires about 35 watts to run it at a speed of 2,100 r.p.m.

The two figures show the positions and dimensions of most of the parts of this interrupter. *B, B* are the two coils, and *C* the core of the electromagnet, *D* being an angle of brass which holds it in place. *I* is the copper disc, or rotor, *N* the jewel bearing, and *E* the brass nut which holds it in place, and contains mercury to make contact with the shaft. *F* is a support for the top bearing *O*. To this brass support is fastened a piece of hard rubber, *H*, which holds the discharge ball, *M*. *R, R, R, R* are binding posts, two for the exciting current for the electromagnet, and two for the circuit to be interrupted. The latter two are connected to the mercury cup and the discharge ball, respectively.

The electromagnet is made up of laminæ of soft thin sheet iron, to a thickness of ⅞ in. Each leg of this magnet is wound with four layers of No. 26 B. & S. gauge copper wire, well insulated from the core. The two coils are connected in series. There should be ⅜ in.

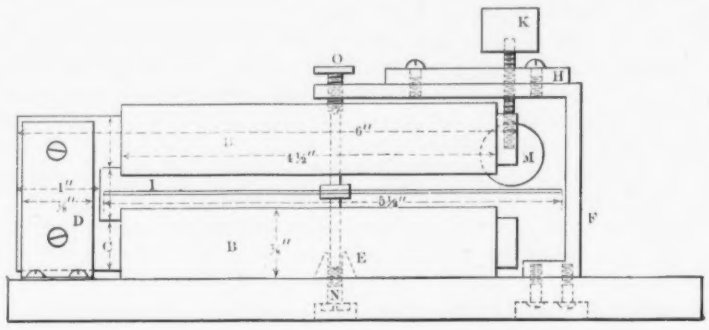


FIG. 1.—HIGH-FREQUENCY INTERRUPTER.

between coils to prevent sparking to the disc. The angle of brass is fastened to the core of the magnet with two small brass bolts, and to the wooden base with two screws. The copper disc is 5½ in. in diameter, and 1/32 in. thick. It is slotted around the edge as shown in the figure, there being 18 slots, ⅜ in. deep. A brass collar in the center serves to hold it to the shaft, which is 2 in. long and ⅛ in. in diameter. The jewel for the bearing is mounted in a screw, and the nut which holds it in place projects enough above it to hold a little mercury, to make a good contact with the shaft, and through that to the disc. It must be understood that this disc has no connection with the current which excites the electromagnet; the two must be well insulated from each other.

The support for the top bearing and discharge ball is made of

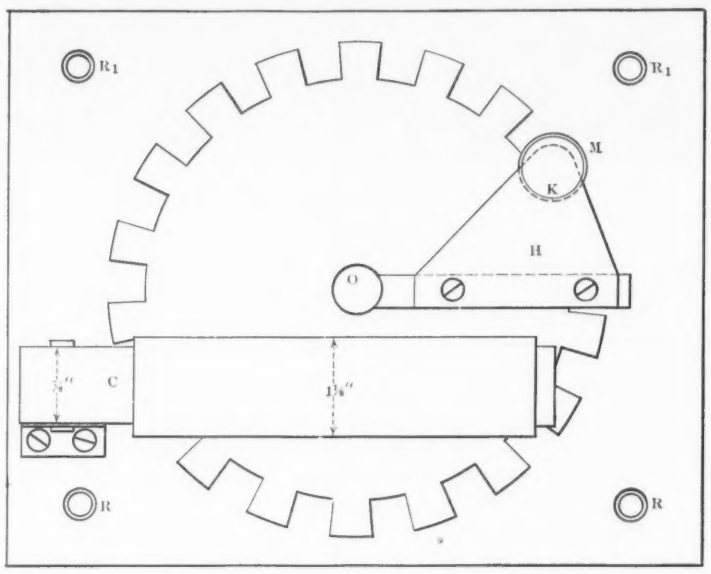


FIG. 2.—HIGH-FREQUENCY INTERRUPTER.

brass, and fastened to the base with two screws. The top of the shaft is cut down for about ⅛ in. to a diameter of 1/32 in., and the screw, *O*, has a hole drilled in it which will receive the small end of the shaft, and allow it a little play. This screw should have a lock nut to prevent its coming loose. The discharge ball is ¾ in. in diameter, and bored and tapped part way through to receive the threaded brass rod which passes through the hard rubber support. This rod has an insulated handle to adjust the ball with; it should be of hard rubber and the ball should be of brass.

This motor is supposed to be run on 110 volts and 125 cycles. The voltage may be changed by changing the size and amount of wire, and for lower frequency more iron must be used. When this interrupter is used on Röntgen ray machines, it should be enclosed to prevent the light and noise from disturbing the operator.

An Electrically-Operated Coal Hoist.

BY RICHARD LAMB, C. E., E. E.

AT this period of electrical development it would seem that in municipalities where electric current can be procured at reasonable figures there should be more coal-handling plants using electricity for motive power than there are. One reason for the slow introduction of electricity in this line of business lies in the fact that the method of control which has heretofore been used is excessively expensive. A varying-voltage generator has been employed, made especially for the purpose of supplying the motor that is to do the hoisting. This same generator cannot be used for any other service while the hoist is in operation. In most coal-handling plants at least two motors are needed, one for hoisting the coal, the other for conveying it to various points for storing. It is, therefore, in such cases necessary to have two generators and two motors when varying voltage system is used.

We know of no coal-handling electrically-operated plant that does not use varying-voltage generators, with the exception of the one hereinafter described. Electrical equipments have, therefore, been very expensive as compared with steam.

It has been supposed that the torque required would be excessive in automatic coal digging bucket operation, that the power needed to draw together the jaws of the digger through the coal would be a dead pull from the start. The writer had arguments with engineers of electrical companies upon this subject, who feared that there

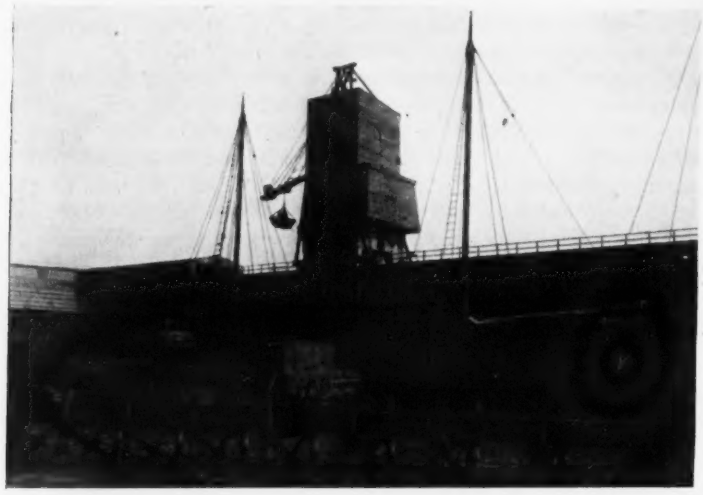


FIG. 1.—GENERAL VIEW OF COAL HOIST.

would be an excessive resistance at the initial movement of the digger. He contended, however, that if the resistance of the coal was greater than the power necessary to elevate the bucket, the bucket would rise and not dig, which would be contrary to the facts as shown in the common use of these buckets. The weight of the bucket has much to do with its automatic loading. The initial resistance is not excessively great, and is not at its maximum immediately, but increases as the current is turned on. The service, therefore, admits of using the ordinary street car motor control.

As the bucket is lowered by gravity, the motor service is intermittent. On this account voltage-regulating generators are practically of no greater efficiency than the constant-voltage. The steam power is constant in either case, and the regulation is very quickly made from no voltage to maximum and the duration of application is short, so that any advantage in an electrical hoist using a varying voltage generator, that might have existed in a case where there were comparatively long runs and varying speeds, becomes *nil*.

The problem of the writer in designing the coal-handling plant for Messrs. Rogers & Curran, of Hoboken, was to get the maximum storage capacity that could be secured in a structure to be built upon a pier already built. This pier is in L shape and had to be reinforced by an addition to the foundation of equal strength with the structure as was already built. The depth of the water is about 40 ft., and the width of the pier over all 30 ft. The height of the coal bin above water level is 40 ft. and the height of the moving tower 95 ft. Great care was in consequence necessary in providing for lateral strains upon the whole structure. The plant that was used before the present one was built had a storage capacity of about 1,700 tons, and the hoisting plant worked by steam. Two additional hoisting engines were used to discharge into barges, which acted as additional storage bins. The coal was rehandled from these boats into the bin, or was shipped about the harbor, as might be required.

The reciprocal motion of the hoisting engine in the tower weakened the structure excessively. There was considerable delay and annoyance in adjusting the steam pipes and moving the tower, when

FIG. 2.—COAL HOIST.

the tower had to be moved. A large loss of power was experienced by condensation of steam in the long line of steam pipe. In view of these facts and the fact that a reasonable contract could be made for electric power, the writer advised that the steam power plant be changed to electricity. The cylinders were removed from the hoisting engine and the countershaft extended, upon which an automatic break and an enclosed type 75-hp motor was attached. A controller and resistance boxes were used. The controller is operated by a foot control, especially designed for this plant by the writer. This feature overcame one of the difficulties to be met in electrically-operated coal hoists. The maximum horse-power used in elevating the bucket is 63 hp. The average is 50 hp. Closing the bucket requires 28 hp.

A trolley pole connected with the tower conducts the current from the bare wire leads, situated on brackets on the upper part of the

FIG. 3.—COAL HOIST.

coal trestle. The same trolley furnishes current for both the tower traversing and the hoisting motors.

The traversing motor is an enclosed type of 25 hp. This motor is geared so that when one friction clutch is engaged and another disengaged, the tower can be moved, and by reversing the operation the cableway that propels the distributing cars can be operated with the same motor. At no time would it be necessary to move the tower and run the cableway at the same time.

The tower weighs about 200,000 pounds, and is moved 15 ft. per minute, using about 5 hp. The motor is wired to reverse and drives a 30-in. diameter elliptical grooved sheave, about which is wrapped a ⅞-in. plowed steel cable, which is made taut and anchored at both ends, at the extremities of the coal bin. By the motor revolving the elliptically-grooved sheave, the cable is wound up and paid out, pulling along the tower. By reversing the motor the tower is moved in the opposite direction. This work is a great improvement over the old way of moving the tower.

The boom on which the bucket trolley works is first hoisted by the engine that operates the bucket, so as to clear the rigging of the coal vessel. The tower can then be instantly moved, so as to work in another hatch of the vessel.

The cableway consists of an endless cable, with a tension device at one end. It is propelled by an elliptical grooved sheave driven by the before-referred-to motor. The tracks have a right angle bend. The cars dump automatically, and are filled by the man who runs the motor. The power used is 6 hp.

In the varying-voltage generator plants the bucket is lowered by using a double-throw three-blade switch, which throws out the rheostat from the generator field circuit, and throws the current into the field circuit of the hoist motor. The armature leads of the hoist motor throw from the armature circuit of the generator to the rheostat. This is done to avoid the ordinary drum friction control. The objection to using rheostat resistance in place of fric-

FIG. 4.—COAL HOIST.

tional resistance is in the danger of the dropping of the circuit-breaker from any cause, or the temporary cessation of the current, which conditions are often met.

In plants using overhanging booms or trackways, with automatic catch to hold the bucket as trolley runs into the tower, no device has heretofore been found that would prevent an occasional miss-catch, and the consequent pounding of the 5,200-pound bucket and load against the tower. To hold the trolley from coming in after such miss-catch, the writer put an endless cable attachment to the same, operated with elliptical grooved sheaves. To the sheave in the tower is attached a band break, operated by a foot lever by the hoistman. As soon as the bucket fails to clamp into the carriage or trolley, the foot lever is operated and the trolley is held in place and prevented from allowing the bucket to strike the tower. By an additional spring put upon the catch mechanism by the foreman of mechanics, Mr. Focht, the universal trouble of the dropping of the bucket has been entirely obviated. The confidence gained by the hoistman feeling secure from danger in the dropping of the bucket, enables him to operate the hoist more rapidly.

One man can unload 90 tons per hour, and one man distribute the same in the bins by the cableway cars. The storage capacity of the plant is 6,000 tons. The yachts and tugs can be loaded with maximum dispatch from four elevations, which are used respectively according to the heights of the boats out of the water. The loading cars have scales for weighing the coal, and also recording meters of the quantity weighed, which greatly facilitates dispatch in loading the boats.

Large Power Plant Projected on Grand River in Colorado.

The largest power plant built or that has any reasonable certainty of being built in the near future in Colorado is that of the Colorado Power & Irrigation Company, which is taking active steps to develop 25,000 hp on the Grand River, at Shoshone Falls, nine miles east of Glenwood Springs. This company was recently incorporated with a capital stock of $5,000,000, and its officers are prominent Colorado capitalists, miners and practical power men. The Grand River is the largest river in the State, and at the point of the proposed development the water will be drawn from a watershed 4,350 square miles in extent. The plan is a novel one for that country, as no large dams are to be built. The river in the vicinity of Shoshone and Glenwood Springs flows along a deep canon which is already occupied by the main line of the Denver & Rio Grande Railroad, so that no storage would be permitted at that point, which would interfere with the railroad. The scheme is to build a deflecting dam, probably not over 6 ft. high, just above the Shoshone Falls, and then carry the water in an open conduit 2,000 ft. long to a point where a 70-ft. head can be obtained. About 5,000 hp can be developed at this point and it is planned to build there the first plant.

By carrying the conduit 1½ miles farther about 12,000 hp additional can be developed with a head of 140 ft., or by continuing it for a total distance of 3.6 miles, at a point near the town of Grizzly, about 20,000 hp will be available, with a total head of 225 ft. It is probable that the first and third developments will be made, thus giving, in the two plants, a total of 25,000 hp. This power is figured for a flow of 1,000 cubic ft. of water per second, and the conduit will be constructed to carry that amount of water. The minimum flow of the river is about 800 cubic ft. per second, and with a system of small reservoirs near the headwaters of the Grand River and its tributaries, it is estimated that enough water can be easily stored to supply the full 1,000-second-ft. during the low water season. A feature that may be of some help to the plant is that some of the mines which will use the power developed shut down during the winter and thus will not be in operation during December, the month of lowest water. By building several small dams, none of them over 30 ft. in height, some of the small rivers can be backed up a distance of five to eight miles and in localities where no damage will be done by the impounded water. Sufficient storage will then be provided so that the reservoirs can be tapped one at a time and supply all the additional water that is required. By this method, also, the expense of a single dam 150 or 200 ft. high, which would be required at a point lower down the canon, is greatly lessened, and the element of risk from its failure is also considerably less than with several dams. It is likely that the conduit for carrying the water to the power houses below will be built in solid rock in the side of the canon, cement being used largely in its construction.

The upper power plant, where 5,000 hp is available, will be built first, and it is expected that this plant can be placed in operation within a year. Four 1,000-kw water wheel generating units will be installed and as the head, 70 ft., is comparatively low, horizontal turbine wheels will be used. Actual work has already begun on the construction of the conduit or flume leading to this plant.

At the main plant the generators will probably be installed in units of 2,000 kw. The De Remer water wheel will be used, its inventor, J. R. De Remer, being vice-president of the company and the one who made the original filing for the water power. In order to get the best results at this head of 225 ft. it is expected to have the generators designed specially for operation at the low speed of about 150 r.p.m. In this case three De Remer wheels, each about eight ft. in diameter, will be used for each generator, whereas if standard generators are used with a speed in the neighborhood of 350 r.p.m., as many as five or six four-foot wheels would be required for a generator, larger wheels being prohibited on account of peripheral speed limits.

The absence of a large dam and other favorable conditions will bring the initial cost per house-power for the Colorado Power & Irrigating Company's plants down to very low figures for mountain power plants. It is estimated that the first or auxiliary plant can be installed for $125 per horse-power. As much of the flume for the lower station would be completed by the construction of the first plant, the cost of the lower station will be proportionately less, and

it is believed that it can be installed for $100 or $105 per horse-power.

The company is confident that it can profitably transmit power to Leadville, 60 miles distant, for about $100 per hp-year, and has assurances that at this rate it can easily secure contracts for 10,000 hp. About 1,500 hp could be similarly used at Red Cliff, a mining town between Leadville and Shoshone. For lighting and power in several other small towns along the Denver & Rio Grande Railroad, and also along the probable route of the main pole line between Leadville and Glenwood Springs, it is estimated that 1,000 hp can be used. At Glenwood 2,000 hp for manufacturing and lighting is figured on, and at Rifle, 50 miles west, the estimate is for 250 hp. For irrigating pumps 1,000 hp is allowed, for electrochemical processes already projected, 1,500 hp, and for other definite purposes about 1,000 hp. This makes a total of 18,250 hp, enough to warrant the installation of the power stations.

Three-phase current will be used for transmission and the initial transmission will probably be made at 40,000 volts, with delta connection, providing for changing over to Y connection for 60,000 volts if desired. A double pole line will be run to Leadville so as to provide against accident and to insure reliability of service.

The irrigating feature of the company's plans is also of interest. Just below Glenwood Springs and along the Grand River is 40,000 acres of arid but irrigible land, which, at present, is only developed to a very small extent. The plan generally followed in Colorado of carrying water along in a high ditch from a point some distance above is impracticable in this case on account of the rough country through which the ditch would have to be carried, the expense not being warranted. With the electrical development, however, at Shoshone, electric pumps could be installed in this district and operated to lift water from the river to small storage reservoirs and the irrigating ditches proper. As these pumps could be operated during periods of minimum load on the stations, and the water stored in the reservoirs, it will make a very desirable load on the stations and for that reason the power can be sold for about $50 to $60 per hp-year.

The incorporation papers of the Colorado Power & Irrigation Company include the right to build reservoirs, construct and operate telegraph and telephone lines and railways, acquire timber, mineral and agricultural lands and develop them, and also to do electrochemical work. The officers of the company include the following-named genalemen: President, Albert Sherwin, Leadville; vice-president, J. R. De Remer, Glenwood Springs, president De Remer Water Wheel Company; secretary, E. E. Lucas, Glenwood Springs, secretary and treasurer Colorado Hotel Company; treasurer, C. C. Parks, Glenwood Springs; general manager, L. W. Beard, Denver; chief engineer, F. H. Whiting, Denver; directors, C. C. Hendrie, Denver, and J. C. Beard, Decorah, Iowa. Judge J. Warner Mills, of Denver, is counsel for the company. The business headquarters of the company will be in Denver, with a branch office in Glenwood Springs.

Power Cable Conduits at Niagara.

The Niagara Falls Power Company is making a very important change in the method of running its cables between power house No. 1 and the transformer house. It will be remembered that power house No. 1 and the transformer station are on opposite sides of the inlet canal, the two being connected by a stone bridge over the canal. This bridge was erected for carrying the cables over the canal, and the practice has been to string them through the interior of the structure, but now a new conduit has been built immediately under the bridge.

On January 29 last, it will be remembered, lightning started a fire in the basement of the transformer station, and the flames were carried over the bridge, destroying the cable installation and temporarily putting power house No. 1 out of business. Following this fire, the company built a cable conduit, 805 ft. long and having 24 ducts, from the south end of power house No. 1 around the west side of the Forbes subway, and through 20 of the ducts cables of 1,000,000 circular mils were laid. This relieved the bridge over the canal of some of its cables, and now the new conduit will entirely do away with the service of the bridge, which is being torn down.

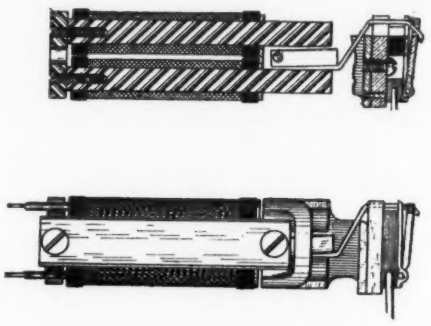
This new cable conduit has 60 ducts, the openings in which are 3¼ inches. The ducts are laid in groups of twelve, and a feature of their construction is that no concrete is placed around them except sufficient to hold them in place. This style of construction was adopted in order that the ventilation might be as free as possible, the difficulty being to get rid of the heat where such an amount of power is carried as passes through this conduit, for all of the load that is transformed, as well as some that is delivered direct, passes over the cables in the conduit. To facilitate ventilation further, ventilators have been placed in a walk that is laid over and a little above the conduit. With this change, all of the current from power house No. 1 and also that from power house No. 2 passes through underground conduits, giving much greater security and removing the danger of a repetition of such a disaster as that of last January.

New Telephone Patents.

In the issue of July 14 brief comment was made, under the title "Local Repeater," upon a device designed to so hold together the transmitters and receivers of two adjacent but disconnected systems that these may act as a repeater and permit of intercommunication between the stations of the two systems. Repeater circuits have always been a source of considerable worry and our comments contemplated that this new device would suffer from the disabilities of all preceding repeating schemes. Mr. J. R. Trowland, the inventor of the local repeater, holds a different view and brings forward a wiring scheme in which undoubtedly the worst difficulty, that of singing, is overcome. This is accomplished, however, by the use of a four-wire, or possible three-wire scheme of wiring for the subscribers' lines of one of the systems. This four-wire line scheme will, of course, be confined to the private or smaller system in which the lines are very short. The expense due to the additional wires considered alone would not, therefore, be prohibitive. When, however, a switchboard for the private system is considered, requiring jacks and other apparatus adapted to interconnect four-wire lines with independent transmitter and receiver circuits, a doubt again arises. All repeater schemes are interesting and it is to be hoped that practical trial will prove the doubts herein expressed without real foundation.

POLARIZED DROP.

A polarized line drop, the invention of Francis W. Dunbar, is the subject of a patent recently granted. This is assigned to the Kellogg Switchboard & Supply Company. Such drops are of service where the divided multiple system is in use, each subscriber having power



DUNBAR POLARIZED LINE DROP.

to signal any one of several parts of the switchboard. Mr. Dunbar's invention relates to details of construction, a side and a sectional view of a drop being shown in the accompanying figure. The drop has a multiple core supported from the shutter plate by formed brass clamping plates. The armature oscillates between the front end of the core legs, the magnetic system being polarized by a bar magnet paralleling the cores and shown in the side view.

LINE-TAPPING POLE.

A few months since a patent of German origin was noted herein which described a telescoping rod adapted to be extended and hook over a line wire that this latter may be temporarily extended within convenient reach. A similar apparatus, without the telescoping features but with a superior contacting device, has been patented by Messrs. J. P. Werner and W. H. Silvey. This contacting device is somewhat similar in appearance to the old style leaf spring snap hook used in harness. The leaf spring is, however, lengthened out so that while a wire may be pulled between the spring and the hook, it cannot leave this position and enter the hook. Thus a tight spring contact is maintained between the wire and hook and yet no great stress is put upon either when the connection is being made or broken.

Recent Electrochemical Developments.

MERCURY CATHODE.

A patent was granted on July 14 to Mr. Leo Gurwitsch, of Kiew, Russia, for a form of mercury cathode (for use in electrolysis of alkaline chlorides, etc.), requiring relatively small amounts of mercury. If a thin jet of mercury flows from an aperture of about 1-64 inch in diameter against a vertical iron plate placed in water, the mercury will spread upon the plate to form a streak of about ½ inch in width. If the iron plate is provided with minute grooves or flutes arranged continuously, the thin jet of mercury will spread out to form a streak of about one inch in width. Thus it is feasible to coat iron plates with very thin and uniform layers of mercury, and to employ them as cathodes without the necessity of setting large quantities of mercury in circulation. The mercury jets, flowing from apertures of about one-third of a millimeter in diameter, are arranged about one inch apart. The lower edges of the plates are bent round and form channels wherein the mercury flowing off is caught up. The inventor proposes to use these plates as bipolar electrodes, only the first and the last plate being connected to the source of current. If the anion should attack the iron, the anodic side of each plate (which is not grooved) is to be protected by an inert, conducting coating or by fixing carbon or lead plates on it.

DIAPHRAGM PROCESS FOR ELECTROLYSIS OF ALKALI CHLORIDES.

The difficulties experienced in the electrolysis of sodium chloride for the purpose of producing caustic soda and chlorine, are mainly due to the fact that, when the products of electrolysis—the caustic soda and chlorine gas—are allowed to come into contact, they form sodium hypochlorite and hypochlorous acid; this reduces the efficiency greatly. This fact has naturally led to the employment of a porous diaphragm for separating the anodic department from the cathodic department of the cell. If simple porous diaphragms are unconditionally used, the passing of the products of electrolysis from one department into the other cannot be completely overcome. It has therefore been proposed to use two diaphragms and to supply to the middle department—intermediate between the anodic and cathodic parts of the cell—sodium chloride under pressure. This would evidently prevent the caustic soda and chlorine from reacting with each other, but this arrangement has the drawbacks of difficulty in procuring low resistance diaphragms which stand the strong pressure, and an accumulation of sodium chloride in the caustic soda department.

A patent was granted on July 21 to Mr. Charles Fournier, of Geneva, Switzerland, for a modification of this scheme, based essentially on the fact that caustic soda is considerably more soluble than chlorine in a solution of sodium chloride. The inventor, therefore, does not exert an extra pressure from the middle department onto the anode department. On the other hand, the sodium chloride is supplied with pressure from the middle department to the cathode department. The latter, however, is arranged in various cells, through which the cathode liquid flows in succession, so that the caustic soda content increases successively from cell to cell; for this reason the pressure with which the sodium chloride is pressed from the middle compartment into each cathode cell varies from cell to cell, and the thickness of the porous walls between the different cathode cells and the middle department is also varied.

The inventor describes the construction of a cylindrical apparatus in which the porous diaphragm is made up of asbestos disks superimposed upon each other. Each disk has a central perforation, and these central perforations of all the disks assembled together form the anode compartment; each disk has also a number of perforations between these central perforations and the periphery, and a number of perforations adjacent to the periphery. The intermediate perforations form the intermediate compartment of the apparatus and the outer ones the cathode compartment. To divide the whole cathode compartment into various cells for the purpose above stated, slate disks are interposed.

PROCESS OF PRESERVING BEER.

A patent was granted on July 21 to Mr. F. Crotte, of New York City, for a method of conveying very small quantities of an antiseptic substance, like boric acid, into a cask of beer. This is done by what the inventor considers "cataphoric" action. The antiseptic substance is contained in a silver plated copper tube, which is placed into the cask so that its lower end nearly reaches the bottom of the cask. At the lower part of the cask, and at a point opposite to the end of the tube, a copper knob is pressed against the cask together with sponge. The copper tube and the copper knob are connected to a source of high-tension current for five to ten minutes.

Profit Sharing for Telephone Employees.

Mr. Frederick S. Dickson, the president of the Cuyahoga Telephone Company, of Cleveland, O., has just issued to the employees of the company a profit sharing circular. The subjoined is the pith of the text and programme:

I am not quite satisfied with your work. I do not think it is very bad, but I am sure it is not as good as it could be, and, therefore, it is not as good as it ought to be. You are doing pretty well, but you are not doing your very best. You know this business was started so that it might earn money for those who invested money in it. Now, money can be made out of this business if good service is rendered to our customers, but the character of our service will depend upon the character of your work. If your work is good, the service will be good. If you are patient, polite, prompt and skillful, you can give very good service with second-rate equipment, but if you are petulant, rude, dilatory and careless, the service will be poor, even if we have the best equipment in the world.

I am not talking to the operators alone, but to every man and woman, boy and girl in the company. Politeness, promptness, patience and skill are just as necessary for the office boy, the collector and the lineman as they are for the operator. There is no excuse for impatience in any official, high or low, who tries to serve the public.

Now, I want all of you to feel that each of you have a real interest in the success of this company. Remember, if we have careless employees, it will reduce our profits. If we have any employees who shirk their full duty, it will reduce our profits. If calls are not answered promptly, our subscribers will leave us and there will be no profits. If our solicitors are not active, we cannot increase our business. If our collectors are negligent, or show want of tact, we will not get paid even for the service we have rendered. Whether we make good profits, or none at all, will depend upon the way your work is done, therefore, I feel that if you honestly help us to earn money, you should honestly share in the money earned, just as you have shared in the labor.

Beginning on July 1st, after paying all expenses, taxes and the interest on our bonds, we will set aside one-fifth of the surplus remaining, and, during January next, we will distribute this among all of you who are in the employ of the company on December 31st, 1903, in proportion to the salary of each. Any one who leaves our employ before December 31st, will have no share in this fund. Any one going on a strike shall forfeit his share. Any one who comes with us at a later date will only receive his fair proportion. In other words, the distribution will be based upon the total amount of salary paid between July 1st, 1903, and January 1st, 1904. Now, what can you do for yourselves and for us on such a basis? If you do not earn a surplus for the company of $5,000 a month during the rest of this year, I will be both disappointed and surprised. If the surplus averages $5,000 a month, it would make a total of $30,000 for the half year. One-fifth of this would be $6,000. In June, 1903, we paid out a total of $11,739.52 in salaries. Distributing such a sum on such a basis would give every one of you an interest in the profits equal to more than half a months' salary.

Remember, the easiest way to make money is not to spend it. Do you realize that all of you are spending money for us? If you injure any part of our apparatus, you have spent the money it costs to repair it. If you cut wire to waste, you have spent the difference in value between good copper wire and junk. If you use a good sheet of paper to figure on, where the back of an old envelope would serve as well, you have added to the cost of operating this plant.

Electricity in St. Peters.

Recalling the opposition once made to the introduction of electric light into St. Peter's and the Vatican, the following pathetic little passage in a cable dispatch from Rome of July 25 says: "It having been remarked that persons passing the Pope's body were hardly able to see the features, especially as they were not allowed to pause, the authorities of the Vatican added this morning to the flickering candles a line of electric globes, fixed over the gates of the Chapel of the Holy Sacrament, the rays falling directly on the face of the late Pope."

Electrical Development in Madagascar.

The growing importance of electricity in new colonies has begun to arouse attention in Madagascar, where the orography and hydrography of the island lend themselves peculiarly well to the applications of water power. Since the French have created roads intersecting the country and have also a railway from the coast to the interior in course of construction, it has been remarked how great a number of waterfalls, especially along the line of railway, are to be met with, all of which are of more than 200 hp.

The River Mandrake, for example, which in a series of waterfalls, has a fall of more than 1,800 ft. over a length of only six miles, although of somewhat feeble volume, lends itself admirably to electrical installations, and being alongside of the great Eastern road it would greatly contribute to the economic development of the country served by that road. The rivers flowing down the western slope of the island afford the same advantages. The central plateau of the island is 4,000 ft. above the sea level, and Madagascar is exceedingly mountainous and exceptionally well watered. In the interior there are many remarkable waterfalls, the names of which it is not necessary to mention in detail, except to quote the two examples of Ramainandro and Kitsamby, each of which has a direct vertical fall of 65 ft., and which, even in the driest weather, would furnish 1,000 hp.

With these general remarks as to the recent awakening of the colony to the mechanical forces lying to hand and only waiting to be utilized it is gratifying to be able to state that General Gallieni, the Governor-General of the island, has made the innovation of lighting the Government buildings at Antanauarivo by electricity.

The plant which weighs about 30 tons arrived from France in December last, and was furnished by Messrs. Sautter-Harle, of Paris. In the machine room are mounted two generating groups of 8,000 to 9,000 watts, working under 120 volts pressure. Each group consists of a petroleum motor coupled directly with a direct-current dynamo, the whole mounted on a cast-iron base bolted to a strong bed of masonry. The machines make 600 r.p.m. The engines work with petroleum used in ordinary lamps of 0.8 specific gravity. There is also a set of Tudor accumulators.

On the 1st of January, 1903, the buildings of the Governor-General were lighted by the new apparatus for the first time, but only the lower stories. The incandescent lamps of the galleries and dining room are of 10 and 16 cp., those of the drawing room 5 cp., but the effect of the latter was novel and pleasing in the centre of the rows of 185 sunken panels which form the ceiling of the vast saloon, and which might have been originally prepared expressly for this effect.

Naturally, insignificant as this may appear in the light of the enormous progress made elsewhere in electric engineering, still for a country which has been for a century so very backward, this first effort does great credit to the French and deserves to be chronicled in the annals of electric progress. Madagascar is now commencing to have a well organized telephone service, especially at Tamatave, and a few long-distance lines, particularly between Tamatave and the capital are at work. By telegraph lines the country will soon be connected in every part, the French having spent $179,640 last year on the Postal and Telegraph Department alone, so that taking all things into consideration, Madagascar may at length be said to have made a start in electricity.

Cabling the News of the Pope's Death.

As was noted in these pages last week, the illness and death of Pope Leo XIII have created an immense amount of cable and telegraphic traffic. Mr. Melville P. Stone, general manager of the Associated Press, says on the subject: "The telegraphic service from Rome was the result of arrangements effected last year. Upon the suggestion of Ambassador Cambon, M. Delcassé, the French Minister of Foreign Affairs, took a lively interest in the work of expediting the Associated Press service. He not only enlisted his colleague, the Minister of Posts and Telegraphs of France, in the work, but instructed M. Barrere, the French Ambassador to Italy, to use his good offices with the Italian Government. Signor Galimberti, the Italian Minister of Communications, joined heartily in the effort.

"As a result, messages which formerly took from five to six hours from Rome to New York are now transmitted in much less than an hour. A number of the bulletins upon the Pope's condition were transmitted from the Vatican, which is over two miles from the central telegraph office in Rome, to New York in twelve, fourteen and sixteen minutes.

"This involved transmission by telephone from the Vatican to the Associated Press office adjoining the central telegraph bureau in Rome, dispatch by telegraph to Paris, relay to Brest, and cabling by the French Cable Company to New York, and finally retransmission by short wire from the New York office of the French Cable Company to the main office of the Associated Press in the Western Union Building, 195 Broadway.

"One bulletin thus transmitted occupied precisely nine minutes from the Vatican. When the condition of the Holy Father became critical, competent men were ordered to Rome from London, Paris and Vienna to assist the local Italian bureau. Notwithstanding the formalities which must be observed, they were able to put themselves in touch with the authorities at the Vatican in such fashion as to enable them to present a graphic picture at all times, including the most minute detail, and the information was forwarded with amazing celerity.

"It is interesting to note that it frequently took less time to transmit a bulletin from the Vatican than to send one by wireless telegraphy from Sir Thomas Lipton's *Erin* off Sandy Hook. Finally, the bulletin announcing the Pope's death was received in New York in time to transmit it to London and deliver it to the papers of the British capital in advance of the receipt of a like bulletin direct from Rome."

Mr. Stone said he had cabled his appreciation of the service to the French and Italian Ministers of Foreign Affairs, as well as to the postal authorities and chief director of the French Cable Company.

Possibilities of Hertzian Waves.

A special dispatch from Paris states that Dr. Le Bon has reported a curious accidental discovery. He was experimenting with Hertzian rays in his laboratory when he was suddenly surrounded by what he describes as a rain of fire from all the metallic objects in the room. He bases upon this a speculation that it would be possible to construct large metal mirrors, capable of reflecting for several miles the Hertzian rays, which, while remaining invisible, would ignite any explosive substance encountered, such as shells and gunpowder in magazines and aboard war vessels and cartridges in soldiers' belts.

Telephone Tax Values in New York State.

A charge or, perhaps more strictly speaking, an inuendo, is given publicity by the *Brooklyn Eagle* in regard to telephone tax valuations in New York State; and it is even asserted in that journal that the subject demands the attention of Governor Odell, a special attack being made on Tax Commissioner Stearns, of Dunkirk. A large amount of argumentation as to tax value is given in the article, and it is claimed that because of long-distance connections the Bell franchises are more valuable than the independent, anyhow. The most concrete and practical part of the article is as follows:

"In Ithaca there are now 1,000 Bell telephones in use and 700 independents. The difference in 1902 was greater, for there has been some growth of the latter during the year, ending June 30, 1903. The valuation placed by the State board was, Bell $4,600, and the independent $4,000. The number of telephones in use is indicative of franchise value at least, and if made the basis of valuation would show that if the Bell valuation is just, that of the independent should be $3,220 instead of $4,000; or if the independent valuation is just, the Bell valuation should be $5,715, instead of $4,600. In New York City there is no opposition to the Bell company—nothing in competition, and there is no basis for a comparison of the valuation. Commissioner Stearns has been set forth as formerly and for a period of time subsequent to his assumption of his office, counsel for Bell interests. It is notable, too, that the most marked instances of excessive valuation of the independent companies occurs in the western portion of the State, whence he comes. It is a notable fact that in Dunkirk, the city of his residence, the valuation placed on the Bell company is $3,400, and that on the independent is $8,000; that the number of Bell telephones in use is 430; of the independent 330, and that the independent is of comparatively recent establishment.

That if the basis of visible property is used for valuation then, if the Bell valuation is the proper one, the independent should be $2,600 instead of $8,000, and that if the independent is proper the Bell valuation should be $10,000 instead of $3,400. It is still more notable that in that now celebrated building in Dunkirk, known as the Stearns building owned by Tax Commissioner Stearns and Supreme Court Justice Hooker, the building of which was undertaken only after the leases for the occupancy of spaces in it were taken by the United States Government through the now indicted Beavers, the Western Union Telegraph Company and the Bell Telephone Company has space, and that on the same floor with and adjoining the law offices of Tax Commissioner Stearns."

In another part of the article the subjoined table is given:

Location.	Valuation on Bell companies.	Valuation on Indep'd't comp'n's.
Cobleskill	$1,500	$2,050
Johnstown	5,000	7,500
Gloversville	9,500	18,500
Auburn	15,000	16,100
Watertown	9,900	15,000
Cortland	4,170	20,000
Elmira	14,500	15,000
Dunkirk	3,400	8,000
Mayville	2,000	2,500
Lockport	4,000	12,000
Niagara Falls	26,000	45,000

Underground Wires in Lower New York.

It is stated that the municipal authorities of New York City have determined to build, in conjunction with the Broadway section of the electric underground railroad extension to Brooklyn, a gallery for the carrying of the water mains, gas mains and other pipes and wires which are laid, without any attempt at proper system, below the surface of the streets in the lower part of the city. The pipe gallery will be built in accordance with suggestions made by Dr. James C. Bayles, the well-known engineer who was employed by Borough President Cantor, and who has made a study of the problem of laying underground wires and pipes. The plans for the gallery have been approved by Chief Engineer Parsons, of the Rapid Transit Commission and by Mayor Low, and by August Belmont, president of the Interborough Rapid Transit Company. The expenditure for the gallery will have to be approved by the Aldermen, but the members of the Finance Committee of the board have promised that the committee will report favorably on the subject.

The construction of a gallery of this kind will obviate, in future, the incessant and expensive tearing up of the streets to repair mains and wires. The wires for carrying power and for lighting will be separated from those used for telephones. All the surface of the street will be restored to public use, unbroken by manholes. The structural features of the pipe gallery conform to those of the railroad tunnel. The electric conductors are to be carried in vitrified ducts built into the concrete. Dr. Bayles says that the advantages of pipe galleries are to reduce danger to life and health from gas leakage, because such leaks can be readily located; for the same reason underground water waste will be entirely avoided and there will be no obstruction to traffic by the tearing up of streets.

CURRENT NEWS AND NOTES.

WIRELESS TELEGRAPH CONFERENCE.—In accordance with the announcements already made, an international wireless telegraph conference will be held at Berlin next week, August 4, to consider the various commercial aspects of the new art. Representatives from all of the leading nations will attend the convention, the idea of which was originated by Emperor William. The idea is to formulate such regulations regarding wireless telegraphy as may be thought to be in the best interests of the nations of the world. The general conditions under which wireless systems can be operated in the different countries will be discussed.

TELEGRAPHERS' UNION.—The Commercial Telegraphers' Union of America, which is now holding in New York its first annual convention, has adopted a resolution, in the preamble of which it is stated that the Western Union Telegraph Company had dismissed many efficient telegraphers throughout the United States because of their affiliation with the union, and endeavored to destroy and disrupt the union. The resolution is as follows: "All fair-minded Americans, workingmen, employers and manufacturers are hereby notified of the action of the Western Union Telegraph Company and its officers, and the public is most urgently requested to rebuke the said company in the strongest way possible."

H. BARRINGER COX IN THE WEST.—The *New York Herald* of last Sunday contains a half-column dispatch from Indianapolis, setting forth that H. Barringer Cox "has discovered a method by which heat may be transformed directly into electricity by means of a simple apparatus which he has completed after years of toil." In an interview, Mr. Cox says: "Some people always brand any apparently extraordinary invention as a fake until they see it in every home. Edison, with his phonograph and his electric lights, Bell with his telephone, Morse with his telegraph, all had to pass the suspicious scrutiny of a doubting public. I have talked to Tesla and Edison about my work trying to invent the little machine you see before you. Edison said, 'Stick it out. Hang to it, Cox. You'll win in the end.'" Continuing, he says that he has hung to it, though at times so poor that he did not have enough to eat and had to leave his investigations to go to work writing on scientific subjects for newspapers. He said that the idea of the apparatus was suggested to him while playing a violin. The only information given as to the apparatus is as follows: "It is only a hollow cylinder of vitrified cement of my own composition, made in a casting in one piece. The deflectors in the centre are as simple as the cast." This description, in a measure, fits the thermopile exploited some years ago by Mr. Cox in the East and in England.

BURNETT LUMINOMETER.—That illumination and not intensity of source is the quantity to be measured in determining the efficiency of light, is becoming more and more to be recognized. Several forms of apparatus for measuring illumination as distinguished from intensity of the source of light have been devised, the most recent of which is described in a patent issued July 15, to Douglass Burnett. In this arrangement the standard lamp is placed in a horizontal tube, all of the sides of which are opaque, except one of the ends, which latter is covered by a photometer screen. At right angles to this screen and extending beyond the box is another photometer screen, which receives the general illumination of the space to be measured. These two screens are viewed simultaneously through a tube at an angle of 45 degrees to the horizontal tube, and therefore at an angle of 135 degrees with each of the screens, an opaque partition extending into the inclined tube from the angle of the two screens. When one looks into the eye tube he sees simultaneously the two photometer screens, and by moving the standard of light in one direction or other in the horizontal tube until the two screens have the same illumination, the value of this illumination may then be read off from a scale, the reading being indicated by a pointer attached to the standard of light and extending through the horizontal tube.

RUDOLPH M. HUNTER IN A NEW ROLE.—The place of honor in the sensational section of the *New York Herald* of last Sunday is given to an article which presents the claim of Rudolph M. Hunter, of Philadelphia, that he has solved the problem of the alchemists, and will soon begin the manufacture of gold on a large scale, with a "yearly profit on the plant" of 57,000 per cent. Two views of Mr. Hunter are included, and one of a massive machine, towering many feet above a workman, who appears to be polishing a moving belt with a smoothing iron. "To forestall the inevitable smile of incredulity and insure a serious hearing," the writer of the article introduces Mr. Hunter as "the original inventor and patentee of the alternating-transforming system of electrical transmission, trolley, conduit and electrical accumulator systems of electric railways, the series multiple controller, electric brakes, electric car heating, etc." In an interview Mr. Hunter says Prof. E. J. Houston has made the statement, "Gold can be made if the split atoms of electrons can be separated and re-collected," and then adds, "I have made and am making it by this breaking asunder of the atoms of electrons." At the conclusion of the interview, Mr. Hunter says that for some time he debated if he should merely convert the gold privately for himself, but finally concluded $500,000 capital is necessary. In a tabulation of figures he then shows a net profit of $16,159,500 on this investment, and adds, "I stake my scientific reputation upon the correctness of these figures."

CAUSE OF GRAVITATION.—We are requested by Mr. Robert Stevenson to say that he will be glad to send to any of our readers who may apply by letter through this office, a copy of a pamphlet, when printed, in which he will develop at length his views on the cause of gravitation.

TELEGRAPH RATES AND CODES.—A cable dispatch from London of July 17 says: "The International Telegraph Conference, which met recently in London, has arranged for considerable reductions in rates and has decided that any pronounceable combination of ten letters will be accepted as a word in code messages.

KOREAN TELEGRAPH POLES.—A cable dispatch from Europe of July 24 has the following: The Tokio correspondent of the *Times* says that M. Pavloff, the Russian Minister to Korea, declares that the removal of the Russian telegraph poles by the Korean authorities was illegal and demands compensation. He says that if this is refused the money will be deducted from the royalty paid by the lumber company. M. Pavloff further announces that he has instructed the company to re-erect the poles. The Korean Government has issued an order for the removal of the poles if erected.

A NEW ILLUMINANT.—According to a consular report from Munich, a Bavarian chemist, Hermann Blau, has perfected a process for the manufacture of a new illuminant. It is stated that the methane and hydrogen are separated from the other constituents of oil gas and liquefied in steel receivers under a pressure of 40 atmospheres. It is said that the light from the gas is of a quality that renders it preferable even to electric light, and by proper mixture any desired quality of illumination may be obtained. The cost per 100 heat units is stated to be 1.13 cents, with round burners, as compared with 1.06 cents for coal gas and 2.14 cents for acetylene.

POSTAL TELEGRAPH EXTENSION IN THE WEST.—The Postal Telegraph Company has entered into an arrangement with the Union Pacific Railroad Company to construct a telegraph system along the right of way of the Union Pacific from Omaha to Ogden, from Denver to Cheyenne, from Ogden to Butte, and along the line of the Oregon Short Line. Poles will be placed in position and wires strung at an early date at Butte, Omaha Denver and Ogden and a division station of the postal system, it is announced, will be established at Denver. This will be the first time the Western Union system has encountered strong competition in the Western States. It is stated that the contract between the Western Union and the Union Pacific Railway provides that no other telegraph line shall be permitted along the right of way of the railroad. The Western Union Company, it is said, has given the Union Pacific notice that the latter will be held to the letter of the contract.

STORAGE BATTERY INDUSTRIAL LOCOMOTIVES.—At the recent Niagara meeting of the Institute, Mr. Edgar H. Berry brought out a distinction that should be made when a storage battery is discharged at a high rate—namely, that it is not completely discharged at the end of the number of hours corresponding to such a rate, but can still discharge for a further period at a lower rate. Consequently, when efficiency is considered, the battery should not be debited with a full charge, since it is only necessary to put back as many watt-hours as were taken out, plus the transformation loss. If this be done, the efficiency on a one-hour rate is nearer 70 per cent. than 41 per cent., which latter figure has been put forth. Mr. Berry pointed out that owing to the usual unskilled attendance on industrial locomotives, there may be considerable loss of energy in the use of starting resistances instead of the more efficient controller combination; and that a locomotive and its motors should be so proportioned that the wheels will skid before either the battery or motor or motor is overloaded.

CIRCUIT-BREAKER TIME CONSTANTS.—In a paper read before the English Institution of Civil Engineers, Mr. Bertram Hopkinson gave the results of some tests to determine the time constants of circuit-breakers when interrupting large currents. In the case of a carbon contact circuit-breaker experimented with, the current remained practically constant .018 second after the circuit-breaker began to operate, this being the period during which the plunger is rising and the switch is closed. At .036 second the current dropped to 3,000 amp., showing that some resistance had been induced, probably by reason of the arc having commenced to form. At .045 second the current was reduced to 2,400 amp., and at .5 second diminished rapidly, being 1,300 amp. at that time. At .058 second the current was almost but not quite shut off, and at .063 second was totally interrupted. In the case of experiments with a magnetic blow-out, the cut-off proper began at the end of .045 second, the current then being 3,500 amp., and at .053 second the current was sharply interrupted. The effect of the magnetic blow-out is thus to interrupt the current much more sharply than in the case of the carbon contact circuit-breaker.

COLUMBIAN CABLE SQUABBLE.—It is stated in special dispatches from Washington that the United States State Department is the victim of a boycott which has been declared against Colombia by the Central & South American Cable Company. That company has discontinued cable service with Buena Ventura, from which point Bogota is supplied with information from the outside world. The boycott will be continued until Colombia grants the company a concession giving it exclusive right to operate cables and land lines on both the Atlantic and Pacific sides of the Isthmus of Panama for the period of twenty years. The State Department cannot now communicate with its representatives at the Colombian capital except by mail. The same is true of Colombia with respect to its minister here. The object of the company is alleged to be to force Colombia into the agreement desired so as to use the concession as a club over the head of the United States in case the Panama treaty is ratified. The United States could not build the canal without first making terms with the company. Colombia has so far resisted the demands of the company, which cut off the service with Buena Ventura three days ago. At the time it issued notice of the suspension of the service it called attention to the fact that there is a fortnightly steamer service between Buena Ventura and Panama, the point to which it still sends messages. The present concession of the company has a year to run, but that fact does not help the Colombian Government any. To forfeit the franchise would merely cut off the slow communication that is now maintained via Panama and the steamer to Buena Ventura.

LETTERS TO THE EDITORS.

Three-Phase Power Measurement.

To the Editors of Electrical World and Engineer:

SIRS:—Referring to the use of two wattmeters in three-phase circuits (discussed in your issue of July 4), and the determination whether the watts consumed by the circuit are the sum or the difference of the two wattmeter readings, there are some cases in which this can be easily determined.

1. We open the main circuit of the wattmeter which has the larger reading (this is always positive). Then the indication of the other wattmeter will always be positive, being now in a single-phase circuit.

2. We change the amount of the load in the three-phase circuit without changing the character of load. (For instance, if we have induction motors on the line, we put a heavier or smaller load on them without changing the number of motors.) If the lower reading wattmeter indicates more at increasing and less at decreasing load, then both wattmeters indicate positive watts. In the opposite case, the small indication is negative. This is true as far as the power factor of the induction motors or any other apparatus increases at increasing load.

PITTSFIELD, MASS. HENRY PIKLER.

Technical Trade Requirements in the Philippines.

To the Editors of Electrical World and Engineer:

Sirs.—For the past four years I have received by nearly every mail circulars, catalogues and descriptive flyers of various electrical apparatus from dealers and manufacturers in the United States. Sixty per cent of these are sent with no prices, discounts or any date, to enable me to base calculations upon, thus necessitating either cabling, which is very expensive, or a long wait to obtain replies by mail. Might I ask you to suggest to your numerous clients the

advisability of giving quotations with confidential discounts to those in the trade when sending out their matter? Foreign firms, English, German and Italian, who are in the electrical business, give this data. Another matter that should merit attention from our manufacturers is the making out of all invoices in triplicate, as the custom house files the original and the duplicate. All invoices must be signed by the shippers, weights are required in kilos, both net and gross of the packages, and all the packages must be numbered consecutively and correspond with the numbers on the invoice. Failure in these details results in a fine being imposed by the custom house. By "net weight" is meant the weight of the goods with the weight off of all wrappers and packing. By gross is meant the entire weight of the package. Packages should be very secure, and strapped, to avoid breakage. Weights net and gross should be shown on each package very legibly.

While all these items are annoying to Americans, still the rules of the customs are such that these must be complied with, until a wise and beneficent Congress gives us free trade between the United States and these islands.

Manila, P. I. Henry D. Woolfe.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Induction Motor with Commutator.—Latour.—A paper discussing the principles of his motor, repeatedly mentioned in the Digest, before the Soc. Intern. des Electriciens, Paris. Experiments with a 15-hp motor, built according to his ideas, were then described by Gratzmueller. The machine was bipolar and the experiments have been carried out with a frequency of 25. Curves are given showing the characteristic of the magnetic circuit of the machine and the conditions of running as series motor with 200 volts, indicating the variations of the speed and the tension between the non-short-circuited brushes of the rotor. A curve is also given for the starting torque as a function of the tension at the motor terminals, from which it appears that the starting torque is more than 4½ times that of the normal one. A slip and efficiency curve as shunt motor is shown, according to which the shunt motor has a practically constant speed, like a direct-current motor. Gratzmueller states that the experiment has completely verified the theory.—*Bull. de la Soc. Intern. des Elec.*, June.

Power.

Equipment of Docks.—Pitt.—A paper read before the Engineering Conference in London, with discussion, on the modern equipment of docks, with special reference to hydraulic and electric appliances. The author reviews the conditions obtaining with each of these two motive powers and summarizes his conclusions as follows: 1. The first cost of an electric installation is not more than that of a hydraulic plant. 2. The cost of upkeep is no more. 3. The electric machines are more efficient and take less power for the same amount of work done. 4. The power is less costly to generate. 5. The transmission costs are less. 6. The general adaptability is incomparably greater.—Lond. *Elec.*, July 3.

Factory Power Plant.—A short article, containing a description of the extension of the electric motive power equipment of a large bicycle plant. Power was furnished by electricity generated by means of steam engines and when extension became necessary, it was decided to utilize a water power available at a distance of 200 meters from the works. Three turbo electric units of 150 kw each will be installed, the turbines driving, by belt, three triphase alternators of 2,200 volts 50 cycles. The exciting current is furnished by three 3.5-kw exciters, mounted on the shaft of the alternators. As the system adopted for driving the machine tools is direct current of 110 volts, the current is stepped down at the sub-station at the works to 70 volts, which feeds three rotary converters of 100 kw each, furnishing direct current of 115 volts.—*L'Ind. Elec.*, June 25.

REFERENCES.

Automatic Starter for Air Compressor.—A description of a large air compressor in the shops of the St. Louis Transit Company for supplying air to compressed-air tools and for cleaning. It is provided with an automatic starter, which differs from the usual starter, in which a rheostat handle is moved over the different rheostat contacts. The rheostat coils are thrown into circuit by means of a number of contacts operated by separate magnets, which cut out or short-circuit the resistances automatically, according to the pressure in the air reservoir.—*St. R'y Jour.*, July 18.

Electric Motive Power in Car Works.—An article describing the recent additions to the power plant and mechanical equipment of the Stephenson car shops. A 450-hp generating set and a large number of additional motors aggregating upwards of 200 hp, have been installed, making the total capacity of motors approximately 1,100 hp. Pneumatic tools are also employed in several departments and portable motor-driven air compressors are moved about the shops to furnish the power wherever it may be needed. An electrically-driven forger is another interesting addition to the plant.—*St. R'y Jour.*, July 4.

Electrically-Driven Armor Plate Planer.—An illustrated note on a recently constructed 32-ft heavy plate planer. A 50-hp multipolar motor is direct-connected by means of gearing and magnetic clutches to the main driving screw of the planer. The motor is of 220 volts and runs at slow speed. It furnishes ample power to enable the machine to plane two-inch armor plate, taking a heavy chip.—*West. Elec.*, July 11.

Traction.

High-Speed Electric Traction on Railways.—Jacomb-Hood.—A paper presented before the recent engineering conference in London. The author discusses the subject from the standpoint of the railway engineer. He treats the subject under three headings, viz.: generation of current, consumption of current and transmission, distribution and collection of current. He thinks that after taking account of the increased cost and losses in extended transmission lines, reason would seem to dictate that the power stations should be as widely separated and as few in number as possible, to insure a steadier load and a better load factor. As power station practice is rapidly becoming standardized in detail, he thinks that it can be foreseen with some confidence that moderate-speed engines, directly coupled to alternators generating in single or multiple form at tensions as high as circumstances will allow, will be used. The author then discusses the difficulties from the standpoint of the railway engineer of the distribution and the transmission of the current.—Lond. *Elec.*, July 3.

The Position and Protection of the Third Rail on Electric Railways.—Langdon.—A paper read before the Engineering Conference in London, with discussion. The author gives a table showing the location of the positive collector rail on a number of main line steam railways and interurban, elevated and underground railways where electric traction has been installed. The distance from the top of the positive rail to the top of the track rail as well as the distances from the track gauge line to the center of the positive rail are given. The protection of the conductor rail with respect to climatic effect and accidental or intentional interference, is also discussed. Such protection it is thought may be better effected by adopting a roof cover instead of the usual planks on one or both sides of the rail.—Lond. *Elec.*, July 3.

The Electrification of British Railways.—A British Engineer.—A long article illustrated with maps. Two of the large steam railway companies of Great Britain have decided to install electricity on some of their branch lines. There seems to be great activity in this direction, also in continental Europe. In England a bill has been introduced to allow steam railroad companies to use electricity as a motive power, to build generating stations, etc. There have been several reasons for the British companies holding back from work of this kind. One is that the limit in speed with steam locomotives has not yet been reached and could probably be increased

some 10 or 20 per cent., but as higher fares could probably not be charged there would be no reason for going to the expense; another reason is that coal is cheap, while water power is practically non-existent; a third reason is that the companies are very heavily capitalized now, as it has not been the practice in Great Britain to charge off anything for depreciation, and some of the companies are still carrying on their books, at their full value, apparatus that was purchased 30 years ago and is now obsolete. There has been so little unanimity of opinion among electrical engineers as to the proper equipment for heavy railroad service, as instanced in the dispute over the electrical equipment of the Inner Circle, that steam railroads have found another reason for postponement of action. Two important companies have the idea that self-contained steam motor cars, either of the Serpollet type or operated by petroleum, would be preferable and have built motors of this kind. The writer believes, however, that the experience in Belgium with such steam motor cars and in Italy with accumulator cars is such as not to encourage construction of this kind. With the electrical equipment of the District Underground Railway, there will undoubtedly be greater interest felt in the subject, especially as some of these underground lines in the suburbs come to the surface and do a regular suburban business. A number of maps are given of the districts in which the competition between tramways and railways is most keen. The writer comments on a number of these maps and points out local conditions. He believes that in the next 5 or 10 years many of the steam railroads will be driven to operating their suburban traffic electrically.—*St. R'y Jour.*, July 4.

Interurban Railway in Iowa.—An illustrated description of a line 23½ miles in length. The company hauls freight, including a considerable amount of live stock. It also has one electric locomotive and carries package freight in an express car, which makes from two to three trips a day. Polyphase transmission is used, with direct current on the trolley wire. Every car carries a telephone and there are plugs at each turnout, so that the car crews can talk with the dispatcher.—*St. R'y Jour.*, June 20.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

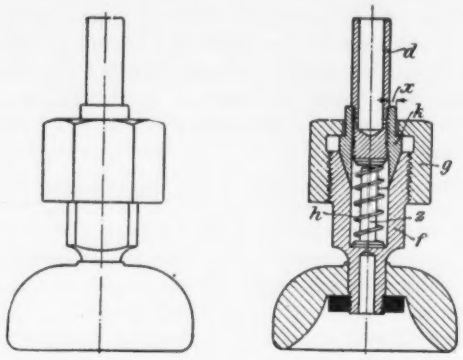
Power Station Generators.—An illustrated description of the 600-kw, double-current generators at the Trafford Park (England) power station. The machine has 20 poles, with laminated pole pieces. They carry both shunt and series field windings in order to run the machines shunt or compound. The armature is of the slotted drum type, and is built up of 15 segments, each of which consists of 774 stampings, 0.5 mm thick, and of six end stampings 2 mm thick. Each armature segment has 31 slots and a half slot at each end, amounting for the whole periphery to 480 slots. The winding consists of 480 form-wound double coils, the bars of which are 3 mm by 4 mm bare and 3.5 mm by 4.5 mm insulated. The winding pitch is from 1 to 98 to 195, and so on. There are 960 segments on the commutator. The machine is directly coupled to a 1,000-hp steam engine at 180 r.p.m. Its normal capacity is 600 kw either for continuous or alternating current or both simultaneously, but it will give 825 kw for 15 minutes without undue electrical or mechanical strain. Three-phase current is generated at 325 to 355 volts, regulated by field resistances, and at a frequency of 30 cycles per second. The guaranteed maximum temperature rise in any part of the machine, after an eight-hour test at full load, is 70° F. The specified efficiency at full load is 95.5 per cent., and at half load 93.5 per cent.—Lond. *Elec.*, July 10.

Construction of Central Stations.—WIKANDER.—An article in which the author discusses the installation of central stations with a view of obtaining the greatest efficiency. He discusses the principles governing the location of a station, the disposition of the buildings, and the machinery equipment, consisting of boilers, pipes, engines, dynamos and boosters. He concludes that as the load on central stations is a very variable one, it is of advantage to choose the equipment with a view to this condition, and consequently to install more expensive, economically working boilers, engines and dynamos for the permanent load, and cheaper, less economic aggregates for the short times of high load and for reserve. He states that there is a great difference of opinion with regard to boilers, i. e., whether tubular or water tube boilers should be installed. He thinks it most favorable, however, to choose a mixed system and to install tubular boilers at least for the permanent load. For steam turbine central stations, in order to get the full benefit of the advantages, there are also required boilers which occupy a very small space. New types will therefore have to be constructed, leading probably to water tube boilers with narrow tubes and large heating surface, or to vertical boilers. Too little attention is paid, according to the author, to the question of the steam mains, they being generally diminished for maximum load and 20 to 30 meters steam velocity per second. For average load they are, however, much too large and give rise to enormous condensation losses. The author proposes as a solution only to provide one steam main, with such dimensions that at maximum load there is reached a maximum steam velocity of about 80 metres per second, or to arrange a second main with only ½ to ¼ of the sectional area of the first, using both mains at the times of maximum load and at other times such other one as conforms best to the average load. On the question of large dynamos the author is of the opinion that a division of them into two smaller ones, situated close to each other, would be advantageous, from 1,500 kw on. For equalizers he advocates the direct coupling with the main dynamo. With regard to the contention that such direct coupling of the two machines on account of the small number of revolutions of the main dynamo, will be too bulky and costly, the author thinks that it is erroneous, because the fact is not taken into consideration, that in the first place two small machines have to be provided and secondly the main machine has to be made larger. The main reason, however, is the very low average efficiency of the small aggregates, 40 to 50 per cent. of the energy being lost on an average. He advocates placing the small dynamos on the main shaft in such a way that the brushes can be taken off and the machine kept running as a fly-wheel, when it is not in use.—*Elek. Zeit.*, July 2.

New Electricity Works in Manchester.—The conclusion of the illustrated article previously noted in the Digest. Extensions in course of construction comprise a generating plant of 12,000 hp, in buildings designed to accommodate twice that amount. The steam will be furnished by 12 water tube boilers, each of 5,700 sq. ft. heating surface, and capable of evaporating easily 20,000 pounds of water per hour. Parallel with the boiler house there is to be an extensive range of workshops, including even a foundry, in which any part of the plant can be handled. The generating plant will consist of two 3,750-kw sets, each comprising a 6,000-ihp vertical triple-expansion engine, running at 75 r.p.m., and a three-phase alternator, working at 6,500 volts, 50 cycles. The generators will be of the revolving field type, with the poles mounted on the periphery of a fly-wheel weighing 160 tons and 27 ft. in diameter. For excitation there will be two 200-kw dynamos driven by induction motors, and generating at 200 volts. A description of the equipment of one of the ten sub-stations is given, they being all alike. The standard equipment consists of four 150-kw motor-generators and one 100-kw motor-balancer. Each motor-generator consists of a three-phase motor, receiving current at 6,500 volts, coupled to a six-pole dynamo, giving 375 to 275 amp. at 400 to 550 volts, at 500 r.p.m. The generator is available either as a shunt-wound machine for lighting or compound-wound for traction. The balancer consists of two dynamos, each rated at 255 to 230 amp., 205 to 225 volts, driven by an induction motor at 480 r.p.m. The balancers can be started without difficulty from the alternating side, after which the other sets can be run up with direct current, without assistance from the distributing network, though the latter is available if required. The synchronous motors are excited either from the balancer, at 200 volts, from the lighting bus-bars, or by a special arrangement of slip rings and chokers, each set can be made self-exciting. The latter method is adopted for all sets running on traction, thus making them independent of any faults of the lighting network. The switchboards are in two sets, the high-pressure boards on one side of the room and the low-pressure on the other. Their arrangement is described in detail. A description of two new turbo-generators, which have recently been installed at the Dickinson Street station, is also given. Each consists of two 900-kw dynamos, coupled to a Parsons steam turbine and running at 1,040 r.p.m. The two dynamos of each set are treated as one machine, giving 400 volts, and are used for lighting only.—Lond. *Elec. Rev.*, July 3.

Construction of Electric Safety Devices for Low-Potential Current Installations.—STEIDLE.—An illustrated discussion of the principles of the arrangement of efficient safety devices for low-voltage installations, in order to protect them as well against lightning as against dangers resulting from their transmission lines coming into accidental contact with high-potential current lines. The author

describes a new construction which he has devised, and which is illustrated in the adjoining Fig. It consists essentially of a rod, *d*, to which the transmission wire is connected. The wire entering the station is connected with the metallic receptacle, *f*. A cone, *k*,



SAFETY DEVICES.

of insulating material separates one from the other. Connection between the two is made by means of a wire spiral, *h*. The core, *z*, of the spiral consists of a celluloid rod. In cases where the intensity of the current entering the device is only a little above that which the device can carry, the spiral simply burns out. But under the action of a high-potential current, not only the spiral will burn out in the first place, but there will be an arc produced between the two wires. The heat of the arc will then burn the celluloid core and thus produce a violent explosion, which has the effect of bursting the apparatus and thus disconnecting the two wires. The author states that experiments have been conducted with pressures up to 5,000 volts, showing that the separation is quickly and effectively accomplished.—*Elek. Zeit.*, July 2.

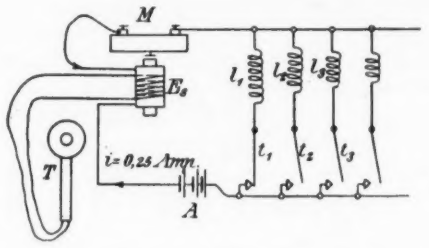
The Design of Extra High-Tension Switch Gears.—WARRILOW.—The first part of an illustrated article. The author states that it is interesting to note that, whereas the design of generators and their prime-movers is practically standardized, much diversity of opinion is to be seen in the controlling gear by the many varieties of apparatus constructed for use on switchboards. As defective types are, however, being weeded out by continued experience, there is hope that few more years will lapse before the principles underlying switchboard devices will have become firmly grounded. A 10,000 and 20,000 Oerlikon air brake switch are described, the author stating that they favor the air break switch for pressures up to 20,000 volts, even at this potential, finding no difficulty in breaking the circuit.—Lond. *Elec. Eng.*, July 3.

ELECTRO-PHYSICS AND MAGNETISM.

Experiments on the Loss of Weight of Radium.—DORN.—An account of experiments conducted by Prof. Dorn to settle the question as to the loss of weight sustained by radium in the course of time. As determined by Heydweiller, there is an appreciable loss even in comparatively short time. His results are directly contradictory of what had been found by Becquerel. Dorn operated on about 30 grams of very active radium bromide and his results do not agree with those of Heydweiller, inasmuch as he finds that the loss is certainly not more than 0.001 mgm in 3 months and perhaps not that much. The radioactivity of the substance used by Dorn was at least ten times greater than that of Heydweiller.—*Phys. Zeit.*, July 1.

On the Radioactive Emanation in Atmospheric Air.—ELSTER AND GEITEL.—A continuation of the experiments of the well-known authors, bearing upon the origin of the radioactive emanation contained in the air in the ground. They found great difference in the ionization of air from different cellars; in one instance the ionization of the outside air being about 11 times greater than that of the cellar air. Samples of ground from different localities were then investigated, and the air contained in them tested. It was found that air which came from ground rich in clay and lime was strongly active, though the different samples were not equal. Ground from a gravel pit and from a slate formation were less active, and still less active were samples from shell chalk and basalt. Experiments were conducted to see whether treatment of the clay with hydrochloric acid had any effect. It was found that a lesser activity resulted after the treatment, but it regained its former value in a few days, the material being kept uncovered. Washed chalk, ground heavy spar, pure potters' clay, sea salt and Carlsbad salts were tried with generally negative results. The authors also tried to find out whether neutral bodies, by burying them in the ground, might take on a sensible induced activity from contact with the ground air. Ground heavy spar, washed chalk, potters' clay and cotton were tried. After at least 4 weeks the materials were taken out, but no sensible activity could be found with the barytes, the chalk and the cotton, while the effect was unmistakable with the clay. It therefore is a curious coincidence, which makes the study of the phenomena more difficult, that clay which contains the body which activates the ground air, is in its turn excited to secondary radiation by the ground air. Natural carbonic acid was also found perceptibly ionized. A pasteboard cylinder, covered with Sidot blende and not showing any phosphorescence, was brought into a tabulated bell of sheet iron, the rim of which reached 25 cm deep into the ground, and charged negatively to 2,000-3,000 volts for several hours. After taking the cylinder out of the bell it showed scintillating phosphorescence, as has been described by Crookes. The latter thought that this phosphorescence is due to the electrons shot off from the radium striking against the screen. The authors think it more likely, in view of the fact that a radioactive body was not present in their experiments, that those scintillations mark the place where negative electrons are given off from the radioactive layer on the screen. Elster also gives an account of a large number of experiments which he conducted in order to determine the dependence of the radioactivity of the atmosphere on the meteorological conditions. He found a decided dependence of the radioactivity of the air on the barometric pressure. He calls attention to the necessity of using exactly the same charging potential of the apparatus from day to day, and also to working with quite constant potential during the time of activation.—*Phys. Zeit.*, July 1.

Generation of Wave Currents by a Microphone Arrangement.—V. LIEBEN AND REISZ.—The authors describe an arrangement of a microphone and telephone, in which, by carrying the resistance of the microphone in a circuit containing self-induction, they were able to get continuous sounds in the telephone. The number of vibrations of the sounds could be easily varied between 300 and 1,000 per second. The experimental arrangements as shown in the accompanying figure, were chosen in such a way that a series of variable self-induction coils, l_1, l_2, could be inserted into the microphone circuit by means of the keys t_1, t_2, etc. *M* is the microphone, *Es* the electromagnet with secondary coil, *T* the telephone and *A* a storage battery. The



GENERATION OF WAVE CURRENTS.

authors think that the easy variability of the vibrations, as well as the sine character of the current waves, present considerable advantages over the tuning fork and string interrupters. This arrangement might, therefore, find a successful employment in the replacement of the above interrupters in Mercadier's multiplex telegraphy. The principle in a somewhat changed form might also find use for measuring purposes, as in the comparison and measurement of self-induction coefficients.—*Elek. Zeit.*, June 25.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrochemistry in the United States.—HABER, T. W. RICHARDS, J. W. RICHARDS, SMITH, BRADLEY, BROWNE, JOHNSON.—The conclusion of the translation in abstract of Prof. Haber's report, the first part of which was recently noticed in the Digest. He discusses the use of diaphragm processes for electrolyzing brine; the simplicity of the operation is pointed out; the ampere-hour efficiency of the production of chlorine varies between 70 and 90 per cent., and is greater the higher the percentage of sodium chloride and the less the percentage of hydroxide in the cathode department. For paper and

pulp mills the diaphragm process is preferable to the hypochlorite apparatus, often used abroad; the latter may have, however, a future in textile mills in this country. Darling's sodium process is said to have been highly interesting as an experiment, but while the process was in operation, it was not proven that it was of commercial value. As sodium is of importance as starting point for the production of various valuable chemicals, it is probable that Darling's experiment may be revived or that new suggestions may be made. Concerning the process of the Atmospheric Products Company, he says that it is still in an experimental stage, and that it is not yet possible to judge with safety what the commercial result will be. He gives a comparison of the relative advantages and disadvantages of the series and multiple system of cells for copper refining and points out the very creditable development of mechanical labor saving apparatus in modern American refineries. Some remarks are made on the Betts process of lead refining. The electrochemical treatment of copper-nickel matte is discussed at great length; after an outline of the commercial conditions before and after the formation of the Nickel Trust, a detailed illustrated description of the Browne process is given. In the first step the electrolyte is a mixture of nickel chloride, cuprous chloride, sodium chloride and ferrous chloride and is electrolyzed between nickel-copper anodes and copper cathodes; nearly all the copper is deposited and the rest is separated by treating the electrolyte with sodium sulphide and filtering the cuprous sulphide off. The solution is then treated with chlorine gas to oxidize the iron from the ferrous to the ferric state and by means of sodium hydroxide the iron is removed from the solution, which is then a mixture of nickel chloride and sodium chloride. It is brought into an evaporator and the sodium chloride is separated out. The solution now contains only nickel chloride and while still hot, it is passed to the nickel depositing cells; nickel is deposited on the cathodes and chlorine is developed at the graphite anodes. This chloride is used partly for oxidizing the ferrous chloride, as mentioned above, but to the greatest part it is supplied to the shot tower in which the electrolyte for the start of the process is made by reaction with fresh nickel-copper shot and the sodium chloride from the evaporator. The process is nearly perfectly cyclic with regard to the chlorine. Haber then makes the following general remark on electrometallurgical processes. The reason why electrochemical processes which were successful in the laboratory often prove a failure in practice, is that in practice it is often difficult to maintain the purity of the solutions. The success of industrial electrolysis of aqueous solutions is mainly a question of maintaining the solutions pure during electrolysis. While the chemical industries in general have grown up in the United States in connection with the older development in Europe, this is not the case with various electrochemical industries which were built up independently of European practice. Haber refers to the pioneer work of Hall, Bradley, Castner, the Cowles brothers, Acheson, Acker and Willson. He thinks that ozone apparatus for sterilizing water and various other electrochemical processes which are used commercially in Europe, should also have a future in the United States. The same issue contains a series of critical notes on Haber's report by American electrochemists. T| W. Richards speaks on chemical education in the United States and Germany; he emphatically endorses Haber's remarks on the practical importance of physical chemistry; whether the present theories advanced by this branch of science are transitory or permanent, knowledge both of its subject matter and of its method is essential as well to the manufacturer as to the investigator in any branch of chemistry. J. W. Richards criticizes some remarks of Haber's on American universities; the golden well-balanced mean between academic pedantry on the one hand and narrow commercialism on the other, is the goal toward which our best institutions are tending and toward which they are advancing more rapidly and more hopefully than European universities. A. Smith emphasizes the importance of teaching physical chemistry, which enlarges our knowledge of the conditions under which chemical changes occur, and consequently the results of physical chemistry cannot be excluded from any instruction in chemistry, from the most elementary to the most advanced. Bradley replies to Haber's criticisms of the process of the Atmospheric Products Company. That company is trying to avoid making mistakes on a large scale and operate single units until they shall be absolutely certain that no changes are necessary. The collection and conversion of the fumes into the various merchantable products are all provided for at a very low cost and the power is the principal item of expense in the operation. Browne emphatically agrees with Haber that it is a fundamental principle in electrometallurgy that everything can be accomplished with pure solutions, nothing with foul solutions. It is the neglect to keep initially good conditions permanently good which consigns so many promising processes to the scrap pile. Johnson discusses the relative advantages of the series and the multiple systems of cells in electrorefining. He thinks there is very little to choose between these two systems, for nickel refining. To meet the general conditions of copper refining, he believes the multiple system to be the simpler and better. There are also some shorter notes by others.—*Electrochem. Ind.*, July.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Hot-Wire Wattmeters.—BAUCH.—A long theoretical article intended to prove the correctness of the measuring principle embodied in the construction of the author's instruments. The instrument is based upon the use of two hot wires, one of which is traversed by the sum of the acting current and a current proportional to the line potential, and the other one by the difference between these two currents. The author deduces mathematically that the indications of the instrument are quite correct even when a phase difference exists. When the phases are equal, the indications are quite correct for a triangular curve and a sine curve. The author also discusses the influence of what he calls the "imparity" factor (or also called "form factor") relating to a peculiarity of alternating currents, which he states has not been treated in electrotechnical as well as in electrophysical science, namely that with equal phase, but different form of a current and a potential wave, the watts are not equal to the product of their effective mean values. This imparity factor, he states, is not to be neglected, if one works with unusual curve forms. From a calculation he comes to the conclusion that the imparity factor calculated from the indications of the instrument, is exactly equal to the true value and that therefore the instrument also takes account of this magnitude without error. In regard to the criticism made, that the scale of the hot-wire instruments is not proportional to the watts, as the elongation of the hot wire is not proportional to the square of the current traversing it, the author finds that this error amounts to only 0.09 per cent., if the instrument is used up to the maximum current strength, for which it was built, even with inductive load. In the practical form of the apparatus, platinum-silver wires of 0.15 to 0.25 mm thickness are used. To reduce the consumption of current in the instrument, both hot wires are connected with a measuring transformer, which steps down the potentials. All paths of the main current in the instrument are perfectly free from self-induction; therefore, shunts can be arranged parallel to the instrument to increase the range of measurements.—*Elek. Zeit.*, July 9.

MISCELLANEOUS.

Carborundum as Furnace Lining.—GREMPE.—The author discusses the advantages of lining fire boxes with carborundum. The mixture is composed of 75 parts by weight of carborundum and 25 per cent. water glass, or, in cases where it can come into contact with basic slags and like materials, of 85 parts of carborundum and 15 parts clay. The author states that a layer of this material of one-half mm thickness suffices for the highest degree of heat met with in practice.—*Zeitsch. f. Beleucht.*, June 30.

Winding Machine for Coils of Flat Copper Ribbon.—A well-illustrated article describing a machine at the Schenectady works of the General Electric Company, which winds automatically and edgewise, coils of flat copper ribbon upon forms which may be circular, oblong with semi-circular ends, square or rectangular with quadrant corners. The coils are for the revolving fields of alternators and the strips from which they are wound vary between .012 in. and .07 in. in thickness, and between ⅞ and 2 in. in width. The interesting mechanical devices by which the winding is accomplished, are described and illustrated in detail.—*Am. Mach.*, July 9.

Utilization of Steam in Mine-Hoisting Engines.—An illustrated article describing installation by which the steam of a large mine-hoisting engine, which works intermittently, is caught in a specially-constructed apparatus. At the other end of this apparatus the steam is conducted with a considerably smaller pressure into a 300-hp steam turbine, which works with condensation and continuously and drives two dynamos of together over 300 hp. A detailed calculation of the saving of power effected by this arrangement is given, which in this particular case may reach 400 hp.—*Glueckauf*, June 13.

New Books.

PHOTOGRAPHIC LENSES. A Simple Treatise. By Conrad Beck and Herbert Andrews. London: R. & J. Beck. 320 pages, 31 illustrations. Price, 75 cents.

Within the past two decades photography has expanded from the narrow circle of the carte-de-visite gallery and has become an art of precision in the hands of the engineer and a pastime for the amateur. The foundation of photography is the lens and the art owes its present remarkable development as much to the improvement in lenses as to the improvement in plates. In the present volume the authors have given a very complete account of the principles which underlie the construction of various forms of photographic lenses, accompanied with photographs both from test charts and from natural objects by which the performance of the various kinds of lenses may be adjudged. The book is written very largely from the standpoint of the manufacturer in his endeavor to meet the wants of the customer, and is decidedly more scientific than will appeal to those who follow photography for æsthetics or pleasure. Nevertheless, the scientific photographer will find therein much that is interesting and instructive and its perusal will particularly repay those who use photography with precision. The book is divided into seven sections, the first three of which are chiefly valuable to the manufacturer. Section 4 upon the properties of lenses is of greater interest to the amateur, as enabling him to select the kind of lens best suited for his purposes. Section 5 describes very fully the types of lenses now to be obtained, and in section 6 the practical application of lenses, accompanied with numerous illustrations, is shown. Chapter VII takes up special lenses and devotes much space to the very interesting question of the telephoto lens. The typography and the illustrations of the volume are excellent, but unfortunately so constant an effort is made to exhibit the Beck-Steinheil lenses in a favorable light, as compared with those of other makers that the volume leaves upon the reader's mind the uncomfortable flavor of a merely trade publication.

L'ANNÉE ELECTRIQUE, ELECTROTHÉRAPIQUE ET RADIOGRAPHIQUE: An Annual Review of Electrical Progress in 1902. Third year. By Foveau de Courmelles. Paris: Librairie Polytechnique. 320 pp. Price, 3 francs 50 centimes.

Although mainly devoted to electrotherapy, this volume contains much valuable information concerning electrical progress in 1902 that has been carefully accumulated and excerpted from the general literature of the period. The first half of the book is devoted to a general review of new facts and theories in conjunction with electric lighting, heating, traction, chemistry, wireless telegraphy, etc.

The treatment of the various topics is simple, clear and precise. It is not, of course, to be expected that over so wide a range of subjects, great detail could be entered into, but for most readers the description will be found sufficient.

The book is specially adapted for the use of physicians and electrotherapeutists who are desirous of becoming acquainted with the most recent electrical developments.

BRITISH STANDARD SECTIONS. Issued by the Engineering Standards Committee. New York: D. Van Nostrand Company. Price, $1.

An example of what useful work may be accomplished by co-operation among professional engineering bodies is furnished by the recent standardization in Great Britain of structural iron sections. The task of arriving at an agreement on standard sections was entrusted to a committee—the Engineering Standards Committee—and the adoption of their recommendations by the Institutions of Civil, Mechanical and Electrical Engineers and Naval Architects, and the Iron and Steel Institute, settles beyond peradventure that the standards fixed upon will prevail in Great Britain. The recommendations cover equal, unequal and bulb angles, bulb ties and plates, Z-bars, channels and beams. A lettered drawing of each section is accompanied by a table of dimensions for all commercial sizes, with remarks as to special points to be observed.

EXPERIMENTS ON THE FLEXURE OF BEAMS. By Albert E. Guy. New York: D. Van Nostrand Company. 122 pages. Price, $1.25.

A book upon the flexure of beams strikes the engineering reader as being excessively trite, for one is accustomed to think of this subject as having been mulled over until the last possible word has long since been said, but Mr. Guy has presented the matter in a decidedly new light, for he deals with the question of the failure not by crushing or bending, but by the buckling of the compression flange and on this aspect there is little engineering literature. Throughout the volume Mr. Guy makes constant and copious citations from the formulæ developed by the best writers upon strength of materials and then proceeds to detail a large number of experiments, which he has conducted upon test beams of various proportions in the endeavor to formulate the laws which govern the failure of beams through buckling. These investigations embrace beams supported at one end and cantilever beams, and for each class experiments are made with distributed and concentrated loads. From his experiments Mr. Guy deduces a new law which he states as follows:

"The maximum transverse section of a beam of length L being divided (rightly conceived as such for the purpose of delineating only, the adherence of the parts being unaffected) into any number of parts—equal, similar, or otherwise:

"1. Any one part may be treated independently of the others, provided that the same form of treatment is applied to the others one by one or altogether;

"2. Each part may be considered as the transverse section of a beam or elementary prism of length L;

"3. The size of the transverse section of such a prism at any point along L depends only on the value of the bending moment, Px, at that point;

"4. Consequently each prism will be of uniform strength, and the combination of all the prisms or the solid beam will also be of uniform strength."

The work is distinctly mathematical in character and by no means easy reading, although it is written in a clear and lucid style and may be regarded as a distinct contribution to the literature on the strength of materials.

Directory of Electrical Societies, Etc.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, C. J. Reed, 929 Chestnut Street, Philadelphia, Pa.

AMERICAN ORDER OF STEAM ENGINEERS. Secretary, Frank C. Rose, 10 Federal Street, Pittsburg, Pa.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty Street, New York.

AMERICAN STREET RAILWAY ASSOCIATION. Secretary, T. C. Penington, 2020 State Street, Chicago. Next meeting, Saratoga Springs, N. Y., September 2, 3 and 4, 1903.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. H. Johnson, Philadelphia, Pa. Next meeting, Thousand Islands, N. Y., September 8, 9 and 10, 1903.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Colby and Abbott Building, Milwaukee, Wis. Next meeting, Indianapolis, Ind., third Wednesday in June, 1904.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Hamilton, Ont., 1904.

ENGINE BUILDERS' ASSOCIATION. Secretary, F. P. Ide, Springfield, Ill.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Wm. J. Davis, Ithaca, N. Y.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., September 2, 3 and 4, 1903.

INTERSTATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. M. Coleman, Louisville, Ky.

IOWA TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Des Moines, Iowa.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, Ernest H. Davis, Williamsport, Pa.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, Utica, N. Y.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty Street, New York.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, T. R. Mercein, 85 Michigan Street, Milwaukee, Wis.

SOUTHERN INDIANA TELEPHONE ASSOCIATION. Secretary, E. W. Pichardt, Huntingburg, Ind.

THE ELECTRICAL TRADES SOCIETY (Member National Electrical Trades Association). Secretary, A. P. Eckert, 39 Cortlandt Street, New York. Board of Directors meets second Friday of each month.

"Meridian" Lamp.

A new type of incandescent lamp is being introduced by the General Electric Company to cover the field of lighting for which the arc light is too large and the incandescent light is too small. From the accompanying illustrations it will be seen that the Meridian lamp is a neat combination of a properly designed incandescent lamp with a suitable reflector and ornamental collar detachable from the lamp. The lamp filament is of special shape and accurately located in the bulb with reference to the reflector. The combinations of these features with sand-blasted globe produces a soft, brilliant white light uniformly distributed. The lamp is very attractive in appearance and effective in results.

The Meridian lamp is as free from all complexity as the ordinary incandescent lamp, and it is claimed that its efficiency equals that of any other electric illuminant except the arc light. It is inexpensive in first cost and in maintenance, and its renewal cost is the same as ordinary incandescent lamps. It may be operated on either alternating or direct-current circuits, on all commercial frequencies and on any of the usual standard voltages and fits in standard sockets, requiring no special connections.

The lamp is designed for interior lighting, not only where artistic effects are essential, as in residences, hotels and theatres, but also where the chief requirement is the greatest amount of evenly-diffused light for the least consumption of energy, as in office buildings, libraries, studios, drafting rooms, factories and retail stores. It is especially suitable for low ceilings and window lighting, and as it is not affected by vibration or acid fumes, can be installed at any angle and in confined and inaccessible places.

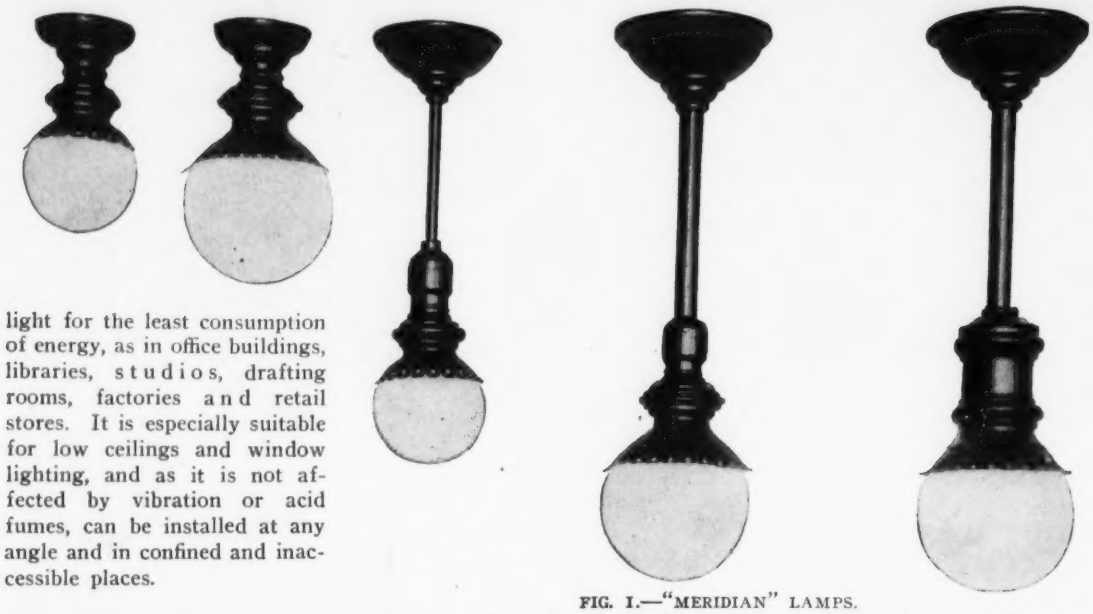


FIG. 1.—"MERIDIAN" LAMPS.

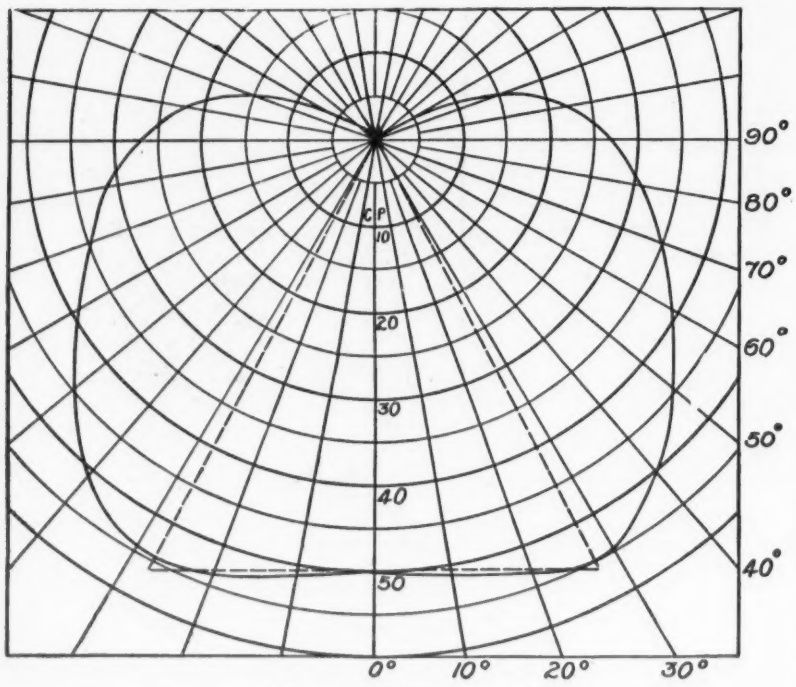


FIG. 2.—ILLUMINATION CURVE.

Each lamp when properly installed distributes a uniform candle-power over a circular area having a diameter equal to the height of the lamp above it, as shown by curves in the accompanying diagram. Thus a lamp suspended 10 ft. from the floor will give a uniform candle-power at all points of a circular area of the floor 10 ft. in diameter.

FIG. 3.—"MERIDIAN" LAMPS.

The lamp is made in two sizes, one giving 25 cp and consuming 60 watts, and the other giving 50 cp and consuming 120 watts. The first-mentioned is especially suited for residence lighting, for deck and table illumination, while the second is best suited for general illumination of interiors of stores, offices, etc. Both lamps are supplied with simple collar and reflector or extension tube fitting, as in various designs, as shown in the accompanying illustrations. The extension tube fitting is the more desirable type, as with the usual height of ceiling it suspends the lamp about eight or ten feet from the floor—a suitable height for good uniform illumination. For very low ceilings the lamp may be used with single collar and reflector, fitting the lamp directly on the ceiling in suitable wall receptacles. For very high ceilings the extension tube fitting with the extra length of tubing should be ordered.

Combined Ammeter and Voltmeter.

An exceedingly useful instrument for general testing work has lately been placed on the market by Messrs. Kelvin & James White, Limited, of Glasgow, Scotland. It consists of one of Lord Kelvin's patent S. R. or moving coil instruments, which can be used either as a voltmeter or an ammeter, terminals and plugs and also a D. P. throw-over switch provided to simplify the alteration in the range of the instrument. Used as a voltmeter the coil has a large resistance fitted in series with it, this resistance being subdivided and connected to sockets arranged around the left side of the instrument so as to enable six different volt-ranges to be obtained as follows: 0 to 0.12, 0 to 1.2, 0 to 12, 0 to 120, 0 to 240, 0 to 600 volts. The instrument has a scale of 120 divisions, and it will be seen that at its lowest range the sensibility is 0.001 volt per division, thus enabling it to be used for low-resistance tests. By throwing the D. P. switch to the right-hand side and connecting the instrument to the various shunts supplied, the instrument can be used for ampere measurement. Four shunts are usually supplied so as to give the following ranges: 0 to 1.2, 0 to 12, 0 to 120, 0 to 600 amperes, but larger ranges can be given, depending on the shunts supplied.

The instrument is fitted in a neat teakwood box, which contains all the necessary plugs, switches, etc., the shunts being supplied in a

COMBINED AMMETER AND VOLTMETER.

separate wooden box. This set can be used for making conductivity tests, either by comparing the deflections obtained from the standard shunt and the unknown resistance with the same current passing through both. By this method resistances as low as 0.0000008 ohm can be measured. Low resistances can also be measured by taking ampere and volt readings when resistances as low as 0.0000016 ohm can be measured. When used for measuring insulation resistances, a sensibility of 4 megohms per division can be obtained. From the information given it will be seen that the instrument has a very wide range, and will be of great service in the testing of meters, dynamos, of cables and for other general testing work.

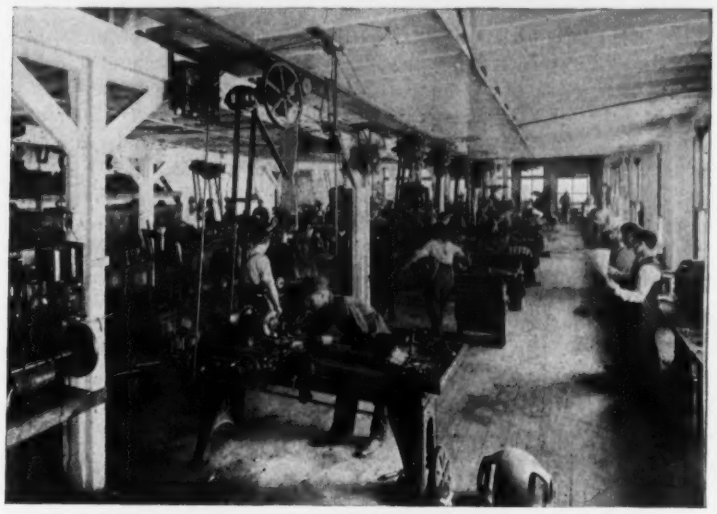
Electric Motors on the Canals.

According to a dispatch from Schenectady, the State Department of Public Works at Albany has granted permission to the General Electric Company to conduct experiments in canal boat electric propulsion along a stretch of the canal in the vicinity of Schenectady. The experiments are to be conducted under the supervision of the department. The plans contemplate the use of a double track.

Dynamo and Motor Production in Chicago.

Roth Brothers & Co. have recently moved into new quarters at 27-29 South Clinton Street, Chicago, which they have completely fitted out with the most modern machinery for the manufacture of their well-known type of motors and dynamos. Their facilities in their new factory are very much increased with a corresponding ability to turn out work very much quicker. This further has enabled them to increase their promptness in filling orders for their standard and also special product. The power apparatus trade has increased to such an extent that it was necessary for them to increase their facilities. They state that their new location in the heart of the machinery district, has proven very satisfactory, and from appearances prospects of very good trade in the near future are assured.

The accompanying photograph shows part of one floor of their machine shop, which, as can be seen, receives excellent light from three sides, and also from skylights. Every machine tool in their shops is fitted out with its own electric motor, many of the motors being direct-connected to their respective machines. For driving their lathes they make use of their well-known electric countershaft, which is an electric motor suspended from the ceiling, having a back-geared shaft upon which is mounted the cone pulley of the lathe. The coarse changes of speed on the line are obtained by shifting the belt on the cone pulleys, and the intermediate speeds are obtained by the controller. The latter is reversible, and is suspended from the ceiling. It is operated by a rod that is connected with a spliced shaft on the lathe, which in turn is operated by a handle which moves with the carriage of the latter.



VIEW OF PART OF MACHINE SHOP.

Aside from their regular product, they have done considerable work of late in the fitting up of machine tools with motors.

Clark Wireless Telegraphy.

At the recent Detroit meeting of the National Electrical Contractors' Association, the Thomas E. Clark Wireless Telegraph-Telephone Company, of Detroit, had an exhibit which was a feature of the convention aside from the sessions, being constantly surrounded by a crowd. As will be seen from the accompanying illustration, the booth was tastefully decorated and was surmounted by a wireless mast such as is used for short-distance work. The exterior was elaborately decorated with Elblight lights and an arrangement en-

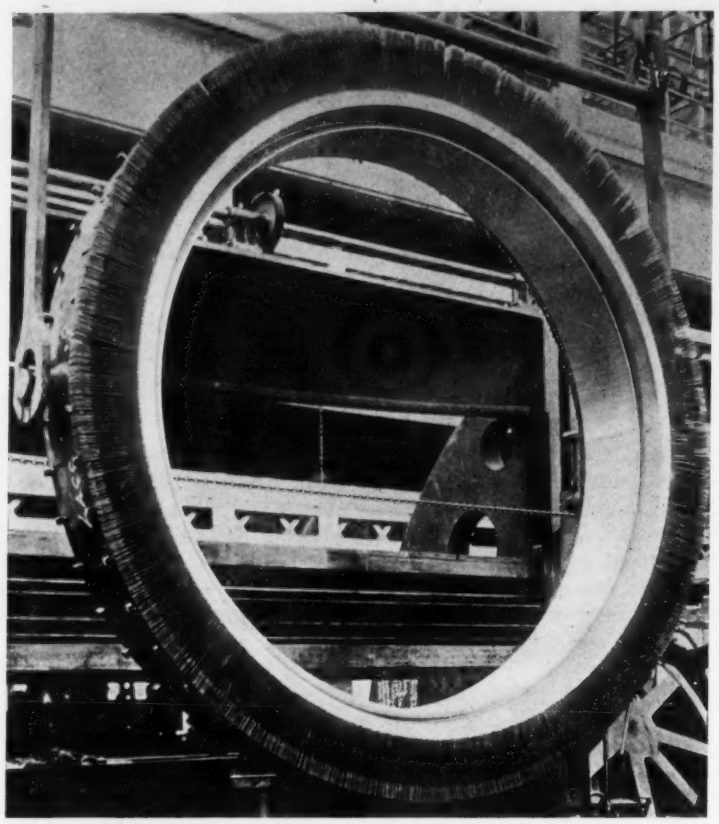
WIRELESS TELEGRAPH EXHIBIT.

abled the oscillations passing between two stations to be observed. The Clark system of automatic signaling or telegraphing from engine to caboose, from one train to another and from a station to trains, was kept constantly in operation and messages were sent back and forth. While the operators of the instruments were professionals, the spectators were invited to manipulate the transmitter, and a line was always waiting to take advantage of the opportunity. All of the large line of Clark wireless apparatus was represented by the exhibits. This exhibit and a similar one in Chicago some weeks ago offered the first opportunities that the public has had to view all of

the many parts of a wireless telegraph system, one or more of these usually being guarded from close public view by wireless telegraph operating companies.

A Large Commutator.

The accompanying cut illustrates the assembly of a commutator, which is to form part of an 1,800-kw, direct-current generator field under construction in the shops of the British Westinghouse Company, Manchester. The generator is being supplied to the order of the City of London Electric Lighting Company, and will be run in conjunction with units of similar size already supplied by the company, and working at the Bankside Station. The external diameter of the commutator is 10 ft., and there are 900 segments, each of hard-drawn copper, around the circumference. The generator is designed for a normal output of 1,800 kw, at 450-500 volts, and will



LARGE COMMUTATOR IN PROCESS OF ASSEMBLING.

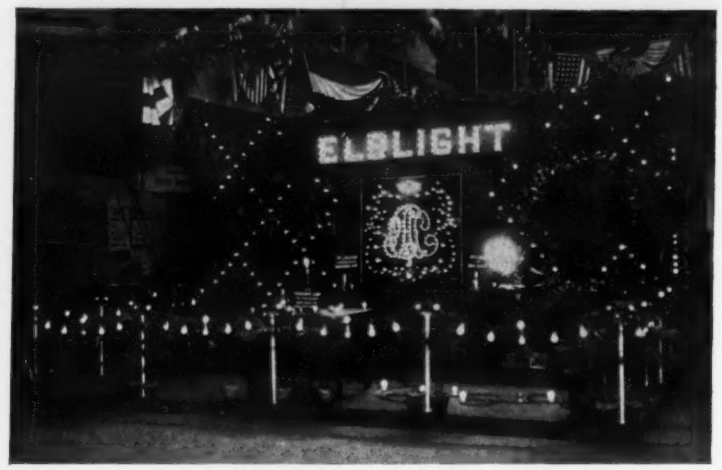
be capable of supporting a continuous overload of 20 per cent. of its total output.

The commutator serves to illustrate the class and size of work being turned out from the Westinghouse works, now that the organization has become settled into definite operation. The development of this large undertaking will be watched with considerable interest during the next few years, especially as some of the largest schemes for power distribution and railway operation are passing through the company's hands.

Spectacular Effects at the Contractors' Convention.

Note was made in these pages last week of the fine lighting displays at the Detroit meeting of the electrical contractors. We now are able to illustrate another exhibit, that of the Elblight Company of America. The entire Light Guard Armory, in which the exhibition was held, was decorated with 5,000 Elblight lamps strung on curves of Elblight cable which formed a trellis over all the main and side aisles between the exhibits and which were profusely decorated with greens. The lamps used were American Beauty pink and apple green in alternation. The outside of the Armory was festooned with white frosted lamps and across the street swung the Stars and Stripes mounted on a flexible Elblight curtain into which lamps were stuck so that lamps and flag followed the undulations produced by the not infrequent breezes which prevail in the City of Straits.

A most attractive and unique exhibition was made by the Elblight Company in the space which had been set aside for that purpose. The chief novelty was the festooned hand rail made of silk cable, into which vari-colored lamps were stuck; the cordon thus formed being decorated with smilax and the supporting iron posts being surrounded with palms. At the back of the space against the wall hung an elaborate iron frame surrounding which the word "Elblight" appeared. Underneath this a four-by-four board was covered with a handsome monogram which appeared in the Automobile Show in



A UNIQUE LIGHTING EXHIBIT.

New York, and which was outlined by several hundred miniature lamps of various colors. An Elblight table was also shown.

The most interesting technical exhibit from the contractors and engineer's point of view consisted of three jars in which lamps stuck on Elblight cable were burning submerged. The center jar contained a lamp mounted which had been burning continuously under water for over four months. To the right a similar lamp was burning in a saturated solution of sea salt and to the left the third lamp was burning in a fifteen-per-cent. solution of concentrated sulphuric acid, showing the weather and water-proof qualities of the system as well as the grade of insulating material employed.

Stone Pipe for Underground Conduits.

A conduit that is increasing greatly in popularity with electrical and contracting engineers and electric lighting, power, telephone, telegraph and street railway companies, is that of the American Stone Conduit Company, of Chicago. The practical underground man will at once recognize on a thorough examination that it combines the essentials of a working conduit.

The method of manufacture is such as to give assurances from the very beginning that the completed structure in the trench will meet all demands made upon it. It is made from crushed limestone and the best quality of Portland cement. In the process of manufacture, the conduit is subjected to an interior pressure of 3,500 pounds per square inch, displacement taking place from the interior, which gives great strength to the wall and a highly polished and smooth inner surface of perfect form. The product is uniform in every particular, and offers advantages not possessed by others. It is made in single-duct, 6-ft. lengths, 4½ in. in diameter, with a 3⅛-in. bore.

The conduit is laid in the usual manner, the best of alignment being secured by means of rubber mandrels, which are furnished by the company. It may be well to note here that the conduit being of the same nature as the concrete, which surrounds the former, a solid mass is formed by the union of the concrete and the conduit, thus forming a system of a single unit from manhole to manhole. This is a most important feature, when it is considered that excavations are frequently made alongside of and under conduit lines, and unless this is able to bridge such excavations, settlement must occur, which not only destroys the conduit, but endangers permanently the cables contained. This, in the case of a short-circuit in any one duct, readily permits of the destruction of the other cables, and consequently removes the very feature which makes an underground conduit system of value. This point will in particular appeal to the high-tension electrical engineer.

The conduit being in 6-ft. lengths reduces the cost of installation, and because of single ducts, will adapt itself readily to any and all obstructions met with in the congested streets of cities. Thus a multiple-duct run can be readily separated so as to allow part of the ducts to be laid above and part below such an obstruction, or separated in a vertical plane. In fact, this conduit can be readily made to overcome difficulties which with a multiple duct, would compel the establishment of a new grade, thus entailing additional expense. Stone conduit will also appeal to the underground man from the fact that it is an ideal system in the case of branch or lateral lines. Although only a single duct may here be laid, nevertheless this, with its enveloping mass of concrete, will form a unit mass that will be strong enough to withstand the rough handling it will subsequently receive. Another feature is the ease with which the conduit can be cut, this greatly facilitating rapid and economical construction. No wrapping or liquid compound is required for making joints, thus insuring a further saving. It is acid, gas and water-proof. The character of the conduit system further insures a minimum of maintenance cost, which is no small item in an extensive system. The conduit, when once laid, will maintain its alignment.

The pulling-in of cable into the finished lines is of the greatest importance, as is well known. With the distance between manholes sometimes met with, this becomes almost impossible with some makes of conduit, the latter offering such resistance that the lead covering, if not actually severed, is very much reduced, and prevents the subsequent installation of the cables at other points. With the stone conduit, however, this is not the case, the interior surface being exceedingly smooth and the ducts in perfect alignment, so that no impedance is offered to the drawing in of the cable. The American Stone Conduit Company is prepared to make immediate shipment on all orders and expects to establish a plant in the east to take care of its eastern business.

High Tension Oil Switch.

A high-tension oil switch embodying several new features of construction, the invention of Dr. Gustaf Benischke, chief engineer of the Allgemeine Electricitäts Gesellschaft, Berlin, is shown in Figs. 1 and 2. Dr. Benischke states that in the operation of such a switch two things are necessary: First, that no air shall enter between

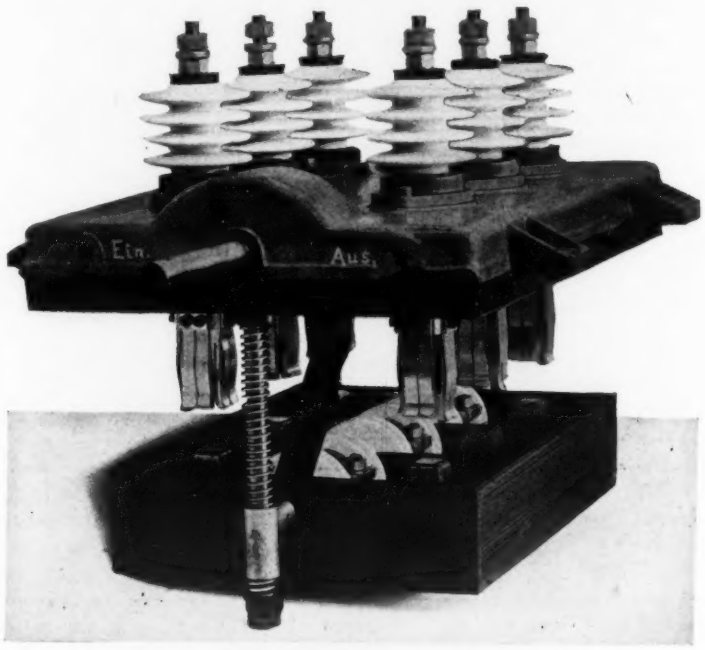


FIG. 1.—HIGH-TENSION SWITCH.

the contacts when the switch is opened; and second, that a dielectric such as oil be forced between the contacts under a given pressure at the instant they are drawn apart. The type of switch here illustrated fulfills both of these conditions.

The line wires brought into the casing of the switch through the lid are secured at *K*, the connection between these being made by the cross piece, *M*. The circuit is broken simultaneously in two places by moving this piece, *M*, downward. Beneath this cross piece and attached to it is a wooden plate, *P*, which when suddenly moved downward, forces oil beneath the switch blade, *M*, and the fingers of the contact, *K*, thus extinguishing the arc before it reaches a length of more than two or three mm (see Fig. 1); in this way the oxidizing of the oil and of the contacts is prevented. Switches of this construction have been tested by short-circuiting a 1,000-hp, 6,000-volt, three-phase alternator, and immediately opening the circuit; under this severe test the break was made clearly and without any appreciable arc.

Fig. 2 shows diagrammatically the latest type of this switch, from which it will be seen that the wooden plate is provided with vertical guide boards to direct the oil between the contacts, and holes are also provided in the board, *P*, immediately beneath the contacts

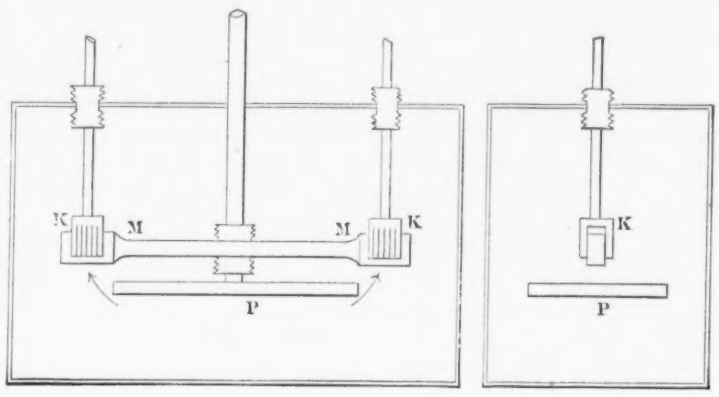


FIG. 2.—HIGH-TENSION SWITCH.

through which the oil is directed against the same. It will be noticed that the contact pieces on the bar, *M*, are tapered to secure good contacts, and that one of the four pairs of switch fingers is longer than the others; it is between this finger and the contacts on *M* that the small arc takes place in opening.

Tests have also been made with this switch by short-circuiting a 1,100-kw, 12,000-volt transformer connected with a 4,000-kw, 6,000-volt alternator. This short-circuiting was repeated ten times in rapid succession, and each time the circuit was cleanly opened. The current in this case was about 300 amp., and, under the short-circuiting, the voltage of the alternator fell from 6,000 to 5,500 volts. Under such excessive tests the oil was considerably darkened, but its insulating qualities were not impaired, the 5 mm withstanding a pressure of 13,500 volts. Under ordinary conditions it is stated that the oil will last several years.

The Steel Industry at Niagara Falls.

The recent merging of the MacPherson Switch and Frog Company with the Ramapo Iron Company, of Hilburn, at Niagara Falls, affects the city materially, giving it an immense new factory furnishing employment to some hundreds of skilled mechanics. The officers of the new company are as follows: President, F. W. Snow; vice-president, W. W. Snow; secretary and treasurer, R. J. Davidson. The board of directors consists of F. W. Snow, W. W. Snow, W. B. Rankine, R. J. Davidson and J. M. Van Winkle. Col. W. W. Snow, the vice-president, is a pioneer in railway supply work, and is known all over the country, being connected with many important industries. He is the father of F. W. Snow, the president.

The capitalization of the Ramapo Iron Company is $1,400,000. The company will still maintain its great plant at Hilburn which has been in successful operation for the past 22 years, and will at once quadruple the capacity of the switch and frog plant, enlarging it to a size equaling that of the one in the east.

Four buildings will at once be erected, and the company has secured sufficient land from the Niagara Falls Power Company to double the new plant when necessary. Because of the unusual facilities for manufacture and the advantages for transportation offered by the new location, it is expected that this increase will prove but a few years distant. Machinery will be installed immediately, including sixteen planers, which will be run night and day, giving an output equal to thirty-two as usually run, and quadrupling the output of the old MacPherson plant.

Bath Electric Tramways, England.

The British Westinghouse Electric & Manufacturing Company, Limited, is now executing a contract for the Bath Electric Tramways, Limited, London, which includes the building of the generating station and car sheds, and the supply, delivery and erection of the entire equipment for the two buildings, in accordance with designs prepared in conjunction with the engineers of the Bath Electric Tramways Company. The generating station equipment is to consist of three 200-kw Westinghouse generators, direct-connected to Yates and Thom horizontal, tandem, compound engines, and one 75-kw Westinghouse generator direct-connected to a Westinghouse compound steam engine. Two 15-kw negative boosters are to be supplied, with a 12-panel switchboard of the Westinghouse tramway type, as well as such other auxiliary apparatus as is involved in a tramway generating station. The boiler house is to be equipped with three 10,000-pound Babcock & Wilcox straight tube, water tube boilers, and a Clay cross economizer; surface condensers are to be used, and also a complete equipment of water-softening and grease-separating apparatus. The car shed is to have a capacity of 40 double-deck, 56-passenger cars. On the second floor and across the front of the car sheds are to be located the offices of the company.

The rolling stock is to consist of 40 cars, the bodies and trucks being of the Milnes make, with Westinghouse equipments. Most of the cars will, at the outset, be equipped with the Westinghouse magnetic brake, which should be found particularly useful on the Bath system, because of the large number of severe gradients.

Rubber Shipments from Para.

The shipments of rubber from the Amazon Valley during May last, according to a report from Consul Kenneday, amounted to 2,070 tons, as against 2,083 tons for the same month in 1902. The total export of rubber for this season—July 1, 1902, to May 31, 1903—is 28,110 tons, as against 28,738 tons for the corresponding period of the previous season. It does not appear likely that the business of this closing month of the season will materially change the relative bearing of these figures. The crop shortage this year, as compared with the year of 1901-2, will, therefore, be only about 2 per cent., instead of 5 per cent., as estimated January 1.

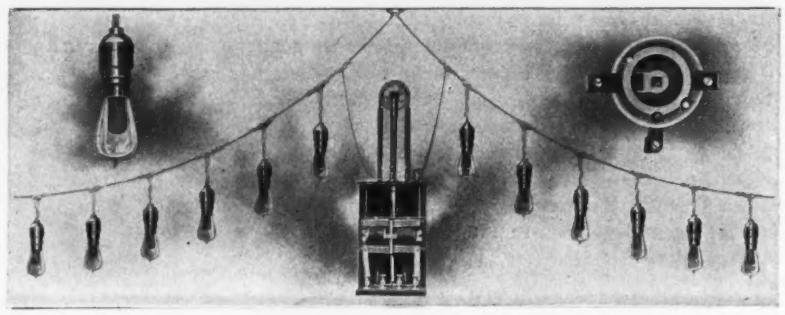
New Double Incandescent Sign Lamp.

The use of electric signs is becoming more and more popular among merchants and business houses generally, and manufacturers vie with each other in producing signs that are meant to catch the eye and still are not too expensive. One of the latest devices produced for electric sign work is the double incandescent lamp illustrated herewith. This lamp has double globes and carbon filaments, with separate connections so that a colored lamp may be furnished by lighting the inner globe, the outer globe being in darkness. The inner bulbs may be made of blue, green, red or amber glass, as desired, while the outer bulb is of clean glass or etched white. When a white light is wanted the outer filament is cut in and the colored bulb left in darkness. Thus with a flasher attachment the same lamp may be made to produce a white and colored light alternately. The socket is arranged with three terminals, one being common to both filaments, and three wires are run to each lamp.

The lamps are made in 2, 4, 6, 8, 10 and 16 cp, and usually, the two bulbs have carbon filaments of the same candle-power. However, in order to produce a stronger light in the colored bulb, that filament may be made to give 2 cp more than the outer bulb.

The new lamp is naturally more expensive than an ordinary incandescent sign lamp with one filament, but when it is considered that one of these new lamps is equivalent to a white and a red lamp, and give the double service in the same space as one ordinary lamp, its advantages can be appreciated. The rest of the new lamp also makes more desirable shaped letters, as every socket is always in use, while with a letter with ordinary white and colored lamp the number of lamps must be large in proportion to the size of the latter in order to bring out the outline with either the white or colored lamps. The new lamps are said to have a life practically as long as the ordinary incandescent lamp, while the efficiency is nearly as good.

The lamps can be flashed by any type of flasher, but the manufacturer makes an automatic flasher for use with the lamps which is an ingenious device, and which possesses several points of merit. This flasher is illustrated in the cut. It consists of two long solenoids, one connected with the white side of the lamps and the other with the colored side. Plungers that operate inside these solenoids are suspended by means of a flexible cable or wire, which runs over the wheel shown at the top of the device. When one of these plungers reaches the bottom of its coil, the current automatically operates one of two small solenoids in front, which throws a switch and connects the other side of the circuit through the other long solenoid. This latter solenoid begins to exert a pull on its plunger, which is now at the top. The plunger is gradually pulled down to the bottom, when it operates the other of the two small magnets and throws the connection over to the other circuit and the other long solenoid. This process is repeated continually, the intervals of flash always being equal, although flashes of unequal length may be made by proportioning the windings properly on the long solenoids. The flashes can also be made to range from



DOUBLE INCANDESCENT LAMP.

1 to 15 seconds, or any given time that may be thought suitable by varying the size of wire or length of the solenoids. By using this automatic flasher the ordinary motor and commutator is done away with, thus saving the current required to operate them.

The new double lamps and the automatic flasher used to operate them are being manufactured by the Electric Flash Light Company, of Denver, Colo., which claims to furnish a sign of two colors and flash them for less money than one can possibly operate a sign made of plain lamps. The Electric Flash Light Company was incorporated last December, and purchased the plant and equipment of the Colorado Lamp Company, which had been manufacturing plain incandescent lamps for several years. The company is capitalized for $150,000, and has the following officers: President, J. L. Beard; vice-president, H. E. Meyers; secretary, treasurer and manager, J. C. Ryan. Mr. Meyers is the inventor of the entire apparatus. The company has recently placed signs in Denver and San Francisco, where they are said to be giving the greatest of satisfaction.

Mining Locomotives for De Beer's Consolidated Mines.

Mule haulage is to be replaced by electric traction on the De Beers Mines, an order having just been placed with the British Westinghouse Electric & Manufacturing Company, Limited, for the supply of twelve mining locomotives with the requisite spare parts, etc. The locomotives have four wheels, each pair driven by a motor of 10-h.p. capacity at a conservative rating. They can thus develop a full load draw-bar pull of about 900 lbs., running at six to ten miles per hour on the level. The most interesting features of these tractors is that the gauge being very narrow—18 inches—the motors have to be mounted clear of the wheels. The motor pinion meshes in the ordinary way with an additional intermediate gear wheel. The journals of the shaft carrying this gear wheel run in boxes working in pedestals over the main journal boxes of the locomotive frame, which is supported on springs in the usual manner, and free to rise and fall on the axles and without disengaging the gears. The motors are hung on the shafts of the intermediate gear as if these were the ordinary wheel axles and the usual "nose" suspension is employed.

Arc Works, Chelmsford, England.

The chairman and directors of Crampton & Co., Limited, entertained a large and influential party of friends recently at the Arc Works, Chelmsford, England, after which all attended the annual athletic race meeting of the Arc Works Club, held in the vicinity. Special saloon carriages were provided for the guests, who, on arriving at Chelmsford, were speedily driven to the works, where they were met by members of the staff, who conducted them over the interesting and extensive works. Great interest was taken in the methods of construction of their dynamo motors, arc lamps, searchlights, fan motors, etc. About noon the guests assembled in an extremely handsome and commodious room in the club buildings, which it appears is the workmen's dining room at ordinary times, and a most excellent luncheon was provided, purveyed by the men's own staff. Carriages were afterwards taken to the race grounds, where an enjoyable afternoon was spent and some really good sport witnessed.

Vacuum Pump.

The vacuum pump shown in the accompanying illustrations, made by the Pulsometer Engineering Company, Limited, Reading, England, is largely used under the name of the Geryk pump for exhausting incandescent lamps, and in laboratories.

Referring to Fig. 2, *A* is the suction pipe, *B* the air port into cylinder above piston, and *C* the piston bucket leather, which is made an easy fit in cylinder, and kept up to the walls thereof by pressure of oil in annular space, *D*. *E* is a piston valve which moves when commencing to exhaust only, and is quite inactive when the vacuum is within about ½ in. *F* is an air pipe to relieve the piston on the first few strokes, and *G* is a collar through which piston rod passes

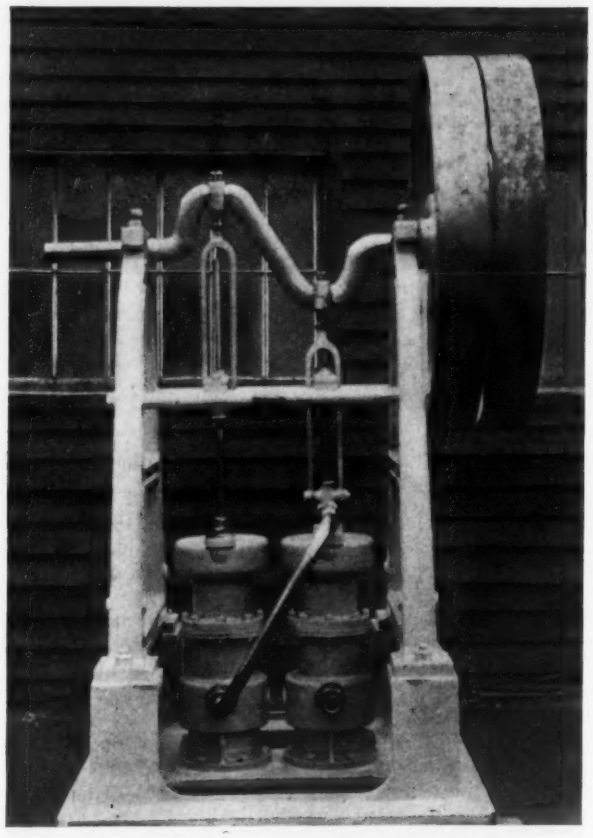


FIG. 1.—VACUUM PUMP.

freely. *L* is an oil filling plug; the oil should fill chamber *K* up the level of oil plug to the point of overflow.

I is a hydraulic collar to make joint with the piston rod, the flange or face of which covers the joint of *G* with the cover, *H*, thus forming a frictionless equivalent of a stuffing box and a delivery valve combined. When the piston is at bottom of the stroke there is a perfectly free opening from *A* to *B*. As the piston rises, the port, *B*, is cut off and the cylinder full of air is irresistibly carried up to the outlet valve, *G*. No air can by any possibility get back past the piston, as it is covered more than half an inch deep with oil. As the piston continues to rise and the pressure upon it increases, the bucket leather is forced more tightly against the walls of the cylinder. Whatever oil gets below the piston is immediately picked up through the valve, *E*, when the piston gets to the bottom of its stroke again. When the piston is at the top of its stroke, it is in contact with the valve, *G*, and lifts *G* ¼ in. off its face, giving a free outlet for the air; but there is so much oil on the piston that a considerable quantity of it is forced through the valve at *G*, driving all air before it. While the piston is at top of stroke the valve cannot close and the oil at *J* and *K* becomes for the time being all one body, so that no air can possibly return, although the valve is fully open. As the valve, *G*, is resting on the piston, it cannot close until the piston has made ¼ in. of its descent, and consequently oil equal ¼ in. in depth will have entered the cylinder ready to be discharged behind the air upon the next up stroke.

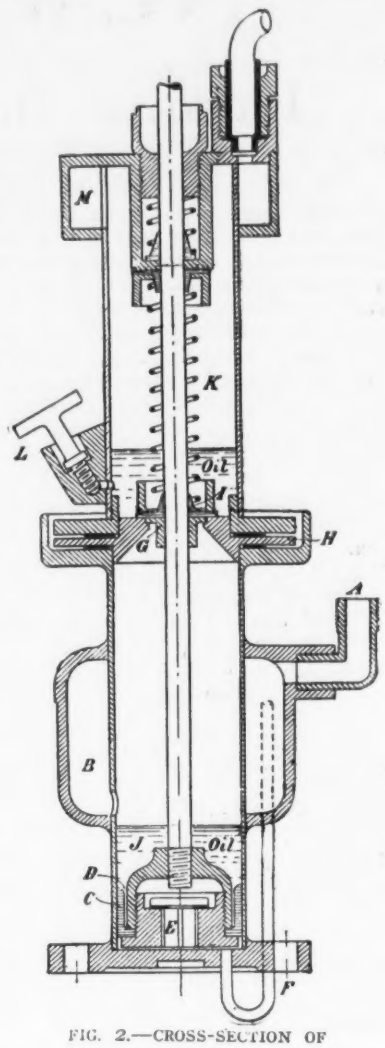


FIG. 2.—CROSS-SECTION OF VACUUM PUMP.

With a single cylinder pump a vacuum within ¼ of a millimetre can readily be obtained. With a double cylinder pump in series, i. e., with the second barrel exhausting from the first, a very much higher vacuum can be produced. With a good drying tube a vacuum within $\frac{1}{5000}$ part of a millimetre (measuring on a large McLeod gauge) has been obtained.

Testing Batteries in Gasoline Automobiles.

The Electric Contract Company, 202-204 Centre Street, New York, is putting a device on the market for testing the batteries used in automobile work. This device, which is shown in the illustration, is intended to prevent the failure of gas engine operation through the weakness of the cells. It is made somewhat after the form of the electric gas lighter, having a platinum coil which glows on touching the terminals of the battery, provided, of course, the battery is still in commission. If the strength of the cell is sufficient to illuminate the platinum coil, then there is current enough in the battery to operate the sparking apparatus. The contact is made by the plug shown in its normal position in the base of the device, which is connected to one side of the platinum coil through a flexible cord. The base itself forms the contact for the other terminal. The tester is a small device easily carried in the vest pocket and should prove a boon to automobilists and others who have fear of trouble from battery weakness.

BATTERY TESTER.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—There was a fair demand for time money, the closing rates being 4½ to 5 per cent. for 60 days, and 5 to 6 per cent. for 90 days to six months. Very heavy liquidation and bear selling depressed prices on the stock market, quotations being in many cases lower than at any time in the past three or four years. The principal selling was in the industrial stocks, United States Steel shares falling sharply. There were heavy dealings in Brooklyn Rapid Transit, the total sales for the week aggregating 112,800 shares, the closing quotation being 41½. This stock reached the lowest point of the year, viz.: 41, the closing price representing a net loss of 9⅝ points. Metropolitan Street Railway also touched the lowest figure of the year, viz.: 113, which was also the closing price, and represented a loss of 5½ points. The highest price was 119. General Electric, on sales of 9,195 shares, dropped from 165¼, the highest, to 155, which was also the lowest for the year, closing at 157, a net loss of 8½ points. Westinghouse common lost 4½ points and preferred 6 points, the closing quotations in each case being the lowest for the year, viz.: 166 and 170 respectively. Western Union closed at 83¼, and was very quiet throughout the week, the sales aggregating 3,869 shares. The Commercial Cable closed at 155, being a net loss of 6 points compared with the last quotations. Following are the closing quotations of July 28:

NEW YORK.

	July 21.	July 28		July 21.	July 28
American Tel. & Cable	77	77	General Electric	162	162
American Tel. & Tel.	130½	131	Hudson River Tel.	..	..
American Dist. Tel.	25	25	Metropolitan St. Ry.	116⅜	117
Brooklyn Rapid Transit	46⅛	44¼	N. E. Elec. Veh. Trns.	..	..
Commercial Cable	..	..	N. Y. & N. J. Tel.	..	..
Electric Boat	15	15	N. Y. E. V. T. Co.	4¼	4⅛
Electric Boat pfd	35	35	Tel. & Tel. Co. Am	..	..
Electric Lead Reduction	1	1⅜	Western Union Tel.	82⅛	83⅛
Electric Vehicle	5	6¼	Westinghouse com.	170	171
Electric Vehicle pfd	13	8	Westinghouse pfd.	170	172

BOSTON.

	July 21.	July 28		July 21.	July 28
American Tel. & Tel	130¼	131¼	Western Tel. & Tel. pfd.	85	80
Cumberland Telephone	..	..	Mexican Telephone	1⅝	1⅛
Edison Elec. Illum.	239	237½	New England Telephone	123	124
General Electric	162	164½	Westinghouse	85	..
Western Tel. & Tel	12	12	Westinghouse pfd.	88⅛	..

PHILADELPHIA.

	July 21.	July 28		July 21.	July 28
American Railways	..	..	Phila. Traction	95¼	94⅛
Elec. Storage Battery	55*	52	Phila. Electric	5⅝	5⅝
Elec. Storage Battery pfd.	..	..	Pa. Electric Vehicle	..	..
Elec. Co. of America	8¼	7⅜	Pa. Electric Vehicle pfd	..	..

CHICAGO.

	July 21.	July 28		July 21.	July 28
Central Union Tel.	..	..	National Carbon pfd.	92	90
Chicago Edison	..	147	Northwest Elev. com.	..	..
Chicago City Ry.	185*	170	Union Traction	3¼	4
Chicago Tel. Co	..	..	Union Traction pfd.	30	30
National Carbon	23	21			

*Asked.

TRACTION MEASURES IN CHICAGO.—A four months' truce in the local traction war has been secured by the passage of two non-committal measures by the Chicago City Council. An ordinance has been passed extending the franchises of the City Railway Company, which the city claimed expired July 30, until November 30, and a resolution adopted empowering the city's legal representatives to agree to an extension of the hearing in the traction suit until the same date. Great care was taken to provide that neither document should be construed as any recognition of the franchise claims made by either company. The protective committee of stockholders of the Union Traction Company, and also of the North and West Chicago Street Railway Companies, which are leased by the former, have been at work on a new lease. Their official statement as to the agreement reached, subject to ratification by the stockholders, is as follows: The old leases between the Union Traction Company and the two underlying corporations are rewritten so that the title to the property is vested absolutely in the underlying companies and the Union Traction Company is merely a tenant. It is provided specifically that the "guarantee fund" shall revert to the underlying companies in case of a default on the contract. While the old rental figures of 12 per cent. for the North Side Company and 6 per cent. for the West Side Company shall be preserved for a period of five years, they are not to be guaranteed, but be simply a preferred stock, cumulative up to the amount of 8 and 4 per cent., these accumulations to be paid before any dividends are paid on the Union Traction Company stock. At the end of the five years, which is supposed to represent the time necessary to put the system into good physical condition, the old rentals of 12 and 6 per cent. are to be fixed again and a guaranteed charge on the Union Traction Company for which the guarantee fund is responsible. The Union Traction Company is to bear all the charges of the rehabilitation of the property.

LAKE SUPERIOR POWER.—With regard to the recent troubles at Sault Ste. Marie, and their effect on the power and traction interests there, belonging in the group of properties, an official report says: "The principal earnings of the Lake Superior Power Company are accounted for in the income from the Helen Mine, which is owned and operated by this company. A large amount of electrical power is furnished to other companies, but this is omitted from these calculations. There are two power contracts, however, which it is proper to include in this estimate of earnings. The Canadian Electric-Chemical Company pay $12,500 per annum, and the International Transit Company will use and pay for about $8,000 worth of power. About $20,000 will come from these two sources." The estimated earnings of the Michigan Lake Superior Power Company are given at $110,000.

CLAUS SPRECKELS OUT OF GAS AND ELECTRIC.—Claus Spreckels has sold his independent gas, power and electric and power companies for a price in excess of $6,000,000 cash. The purchasers are bankers and other capitalists principally interested in San Francisco gas and electric and Pacific coast improvement companies. They have an option already on the Equitable Gas Light Company. The purchase of the Spreckels plant insures an end of the lighting war, which has been in progress five years or more in San Francisco, during which time the price of gas has been reduced from $2.25 per thousand to 50 cents. The rate will be advanced to $1 for gas and 4 and 10 cents per kw-hour for electricity, according as supplied in the business or residence section of the city.

STREET RAILWAY SALE.—The Marlborough (Mass.) Street Railway, consisting of 39,000 ft. of track and several buildings, including a power house, together with cars and equipment, was sold at public auction last week to William A. Quigley, of Boston, for $102,775. He represented the Boston and Worcester Electric Company controlled by James F. Shaw, of Boston. Mr. Shaw was the owner of the railway when it was placed in the hands of a receiver. The sale was the result of an order issued by the courts, and it was conducted by George W. Estabrook, the receiver. The Marlborough road was crippled in 1892 by the burden of claims made against it as the result of an accident on the Hudson division when many persons were injured. The claims amounted to $100,000.

NEW ENGLAND ELECTRIC VEHICLE.—The trustees in dissolution of the New England Electric Vehicle Company have declared a third and final dividend of 26 cents per share, making the total dividend in liquidation $3.76 per share. This third and last dividend was paid July 15 upon surrender of the trustee receipts at the Old Colony Trust Company in Boston or the Manhattan Trust Company, New York. The trustees in dissolution are Francis R. Hart, James E. Hays and Charles L. Edgar.

FALL RIVER AUTOMATIC EXCHANGE DIVIDEND.—The Fall River Automatic Telephone Company has paid its second dividend at the rate of 5 per cent. per year and has a surplus left after charging off depreciation. Its copper toll line connecting with the New Bedford Automatic exchange, has just been completed and the service is said to be excellent. With the opening of the Automatic Company's toll line the opposition announced a cut of 33⅓ per cent. between these points.

CINCINNATI ELECTRIC MERGER OFF.—The negotiations having for their object the taking over by the United Gas & Improvement Company of the controlling interest in the Cincinnati Gas & Electric Company, have, according to advices from Cincinnati, been declared off. The contemplated deal involved $29,000,000 and would have been the preliminary step to the consolidation of all the quasi-public concerns in and around the city of Cincinnati.

THE SOUTHERN ELECTRIC SECURITIES COMPANY has been incorporated at Trenton, N. J., with a capital stock of $1,000,000 to hold as investments bonds, securities and other evidences of indebtedness. The incorporators are Kenneth K. McLaren, Joseph M. Mitchell and Louis B. Dailey, all of 15 Exchange Place, Jersey City, the registered office of the company.

DIVIDENDS.—The New England Telephone & Telegraph Company has declared the regular quarterly dividend of 1½ per cent., payable August 15, to stock of record July 31. National Carbon directors have declared the regular quarterly dividend of 1¾ per cent. on the preferred stock, payable August 15.

CINCINNATI GAS & ELECTRIC.—The earnings of the Cincinnati Gas & Electric Company for the first half of the year, represent the largest income in the history of the company. The entire force of the company is working night and on Sundays in connection with the installation of meters. The company is also increasing largely its installation of 4 amp. alternating-current arc lamps, for street circuits, in the use of which it has been a pioneer. It will soon have over 5,000 of these.

PHILADELPHIA BELL STOCK.—The Philadelphia Bell Telephone Company stockholders have authorized the proposed increase of the stock from $12,000,000 to $16,000,000.

Commercial Intelligence.

THE WEEK IN TRADE.—Stock market liquidation at the expense of industrials, *Bradstreet's* points out, affects the sentiment and ignores but does not conceal improvement in the corn and cotton crops; a change for the better in industrial conditions at New York and other distributing centers and a continued cheerful feeling in Western and Southwestern trade circles. The iron and steel markets and those for other metals feel the reflex action of depression in securities. Strike troubles are reported the cause of dullness in Eastern lumber markets and of the embarrassment of a large building concern. Railway earnings are exceptionally good, showing a gain of 15 per cent. for the first half of July, and the only source of complaint is of car congestion at Kansas City, affecting arrivals of new wheat and dulling Western flour milling operations. Bank clearings show a smaller aggregate than last year, but a gain outside of New York. Trade reports are in harmony with crop advices. West of the Mississippi, from Texas north to the Canadian line, the feeling is optimistic. Texas has harvested a record wheat crop; a large corn yield is assured and cotton reports are good. Hence reports of improving trade. In Kansas and Missouri the feeling is excellent. Northwestern trade advices are cheerful on the expectation that the wheat yield will be little below last year. Pacific coast trade and crop advices are good and building is very active. At the south trade is of full volume with crop advices inducing a cheerful feeling. Industrial operations are active in the central West. The business failures for the week ending July 23, according to *Bradstreet's*, numbered 183, against 173 the previous week, and 178 the corresponding week last year. In the copper market official prices have again been reduced in the absence of business. The closing quotations were 13⅝c. to 13¾c. for Lake and electrolytic and 13¾c. to 13⅞c. for casting stock.

POWER IN CANADA.—The Hamilton Electric Light & Cataract Power Company's steam power station in Hamilton, Can., which will be used as an auxiliary to its water power plant at De Cew Falls, 34 miles distant, is to be equipped with the following machinery recently ordered from the Westinghouse Electric & Manufacturing Company: Two 1,000-kw, two-phase, 2,400-volt, 66-cycle engine type generators, each driven by a vertical Corliss engine furnished by the Goldie & McCulloch Company, of Galt, Ont.; one 50-kw motor-generator exciter set for these alternating-current generators, consisting of one 75-hp, two-phase, 400-volt induction motor and a 50-kw, 125-volt, compound-wound, engine type generator, constituting a two-bearing set; also a switchboard consisting of two generator panels. In the receiving station of the Hamilton Light & Power Company, which adjoins the auxiliary steam power station in Hamilton, will be installed six 500-kw, oil-insulated, self-cooling transformers with transformer panels, stepping down the current from 20,000 volts or 40,000 volts three phase, to 2,400 volts two phase. The two engine type alternators mentioned above will be operated in parallel with the secondaries from these transformers. For the water power station at De Cew Falls, the Westinghouse Company will furnish two 5,000-kw, three-phase, 2,400-volt alternators, which will be direct-coupled to water wheels that are being built in Italy; two 100-kw motor-generator exciter sets, each consisting of a 150-hp, 2,400-volt induction motor, and two 100-kw, 70-volt, direct-current, compound-wound, engine type generators, constituting three-bearing sets; five 2,500-kw, oil-insulated, water-cooled transformers, transforming from 2,400 volts three phase to 22,500, or 45,000 volts three phase. Also the necessary switchboards to control the apparatus recently ordered as well as that already installed in the station, aggregating eight separate switchboards with a total of 18 panels, equipped with oil switches throughout.

LIGHTING EXTENSIONS AT DETROIT.—The Detroit Edison Company is about to install a new motor-generator sub-station in the business district of that city, to relieve the load on its direct-current stations, which are already taxed to their limit. Three-phase, 60-cycle, 4,600-volt current will be supplied from the new power house, which is being built at Delray, and will be delivered to the motors direct, without the interposition of transformers. All switching operations on the high-tension side will be done by General Electric motor-controlled form H switches. The generators will deliver 250-volt direct current to the Edison system, whereas a 3-unit, 400-kw motor-generator balancing set will maintain the neutral. The immediate equipment will include two 1,000-kw units, which it is expected will be in operation by the middle of October, whereas the final installation is laid out for six units. The plans for the equipment are being made under the supervision of Mr. George Cato, the superintendent and electrician of the company. The building, 38 x 100 ft., will be two stories in height with basement, the second story being used as living apartments by the station operator. Work on the new power house at Delray is being pushed as rapidly as possible, and it is expected that current will be furnished by the same in the early fall. This will prove a most interesting installation, not only because of its magnitude, but also because of the economic and engineering problems which are involved, as was pointed out in a paper on "Salt as a By-Product," read before the last convention of the National Electric Light Association by Mr. Alex. Dow, the second vice-president and general manager of the company.

ORDERS FOR WATERTOWN ENGINES have recently been received as follows: Hanson-Ward Veneer Company, Bay City, Mich.; one 13 x 22 x 14 tandem compound high-speed engine arranged for direct connection to Westinghouse generators; town of Lewes, Del., one 11 and 188 x 12 tandem compound high-speed engine, second order; South Norwalk, Conn., Electric Light Company, one 20 x 18 four-valve high-speed engine, arranged for direct connection to Ft. Wayne generators, being the fifth order from this company within five years; Equitable Life Insurance Company, Boston, one 14 x 16 high-speed engine; Merrimack Manufacturing Company, Boston, one 12 x 12 high-speed engine; *Commercial Tribune* Building, Cincinnati, Ohio, one 24 x 18 four-valve high-speed engine arranged for direct connection to Triumph generator; Republican Smelting & Reduction Company, Leadville, Colo., one 11 x 12 high-speed engine, arranged for direct connection to Milwaukee generators; Trow Printing & Publishing Company, one 12 x 12 high-speed engine direct-connected to Bullock generator; National Electric Supply Company, Washington, D. C., one 10 x 10 engine direct-connected to Crocker-Wheeler generator for a fort.

A CAR LOAD OF WATTMETERS.—We have received a photograph representing the recent shipment of a carload of electricity wattmeters (some 1,400 in number) by the Stanley Instrument Company, Great Barrington, Mass., through Messrs. John Martin & Co., of San Francisco, Cal., its Pacific coast agent, to the Edison Electric Company, Los Angeles, Cal. The shipment, intended for the equipment for measurement of current used in the comparatively small installations of general house lighting aggregates, however, a total capacity of upwards of 3,000 hp, and while the instruments are small, the total weight of the shipment was nearly 40,000 pounds. The destination, Los Angeles, Cal., indicates the widespread use of electrical apparatus of the highest class. The wattmeters of the Stanley Instrument Company, besides being shipped to all parts of the United States, have been sent for years to South America, Mexico, Porto Rico, etc., and since the beginning of this year, when an office was established at No. 23 Boulevard des Italiens, Paris, France, a brisk demand for its wattmeters has arisen in France, Italy, Switzerland, Germany, Austria, Hungary, England and the British possessions.

GISHOLT MACHINE DEVELOPMENT.—The Gisholt Machine Company, of Madison, Wis., has recently amended its articles of incorporation, increasing its capital to $750,000. Up to the present time the Gisholt Company has confined itself almost exclusively to the manufacture of the now well-known "Gisholt" lathe. These tools are made in several varieties and sizes, and the line is being constantly extended. The increasing business in lathes has necessitated a very considerable increase in the manufacturing facilities of the company, and additions have recently been made, both in buildings and equipment, that will double the former capacity of the plant. While the new buildings and equipment will be largely used for producing "Gisholt" lathes, they will, in part, be used for the manufacture of other types of machine tools, such as boring mills, etc. The last-named machines, however, will not be manufactured on a large scale until new buildings now in contemplation are completed. Contracts have recently been made by the Gisholt Company for a large new foundry, to be equipped throughout with modern up-to-date appliances. The buildings will be strictly fire-proof.

EXPORTS FOR THE YEAR.—The fact that the exports of the United States in the fiscal year just ended are greater than those in any preceding year except 1900, lends special interest to a statement presented by the Department of Commerce and Labor through its Bureau of Statistics, which shows the relative growth of the export trade of the principal countries of the world for a term of years and compares that of the United States with other countries. The table in question shows the total value of exports of domestic products from the principal countries of the world in 1870, 1880, 1890,

and the latest available year approximating 1902-3. A study of this table of exports from the principal exporting countries of the world shows facts of especial interest to the people of the United States. One of these is that the United States, which occupied fourth place in the list of exporting countries in 1870, now shows a larger total in the final period which represents the latest available year than does any other country of the world, viz.: 1,392 million dollars. The United Kingdom is 1,379 millions and Germany 1,113 millions.

NERNST LAMP PLANTS.—The New Jersey Zinc Company, of Hazard, Pa., is supplying current for the Nernst lamps recently installed in an adjacent silk mill at Palmerton, Pa. Not only is the uniform distribution of light from a plane above the eye of advantage to the employees in the very trying work incidental to the handling of silk, but the total absence of flicker and shadow, together with the daylight quality of the light, is of great assistance in determining the proper colors to be used in the various processes of manufacture in this industry. The Chicago office of the Nernst Lamp Company reports that the Illinois Steel Company, of South Chicago, has recently illuminated its draughting room exclusively with the three-glower lamps, doing away with all desk lights, thereby gaining a superior distribution, as well as a superior quality of light for the use of its employees in the exacting work of tracing and draughting.

TRANSMISSION IN MADRAS.—With regard to the power transmission plant installed by the General Electric Company at Cauvery Falls, in the native State of Mysore, India, of seven units of 750 kw each to transmit power current 92 miles to the Kolar gold fields, Mr. W. T. Fee, United States Consul at Bombay, writes: "So well have the mining companies of the Kolar gold fields been pleased with the use of the electrical power, and so greatly has the output of the mines been increased thereby, that they recently made application to the Mysore government for the delivery on the gold fields of an additional 2,000 horse-power, and that government has now placed orders with the company who supplied the initial plant for the generating and transforming apparatus necessary to deliver this extra power.

EDISON STORAGE BATTERY.—In a recent interview, Mr. T. A. Edison spoke very hopefully of work on his storage battery, a set of which has recently been put on a dry goods delivery wagon in New York City. In the official test made of the new battery in the delivery wagon at Altman's, the books showed that the old lead battery weighed 1,260 pounds and had a maximum of 25 miles, while the Edison battery which replaced it weighed 650 pounds and drove the wagon 36.8 miles. Besides which, the old battery occupied 12.8 cubic ft., while the Edison took up only 8.5 cubic ft. The battery has also been doing good work, it is said, in runs from Orange to Atlantic City and back.

HYDRAULIC PLANT FOR MEXICAN MINES.—The United Mexican Mining & Exploration Company, in which Henry S. Mackay is primarily interested, has been granted a concession by the Mexican authorities permitting of the utilization of the water power that can be generated through the damming of the Rio del Fuerte, amounting, according to the latest estimates, to a minimum of 3,000 hp and a maximum of 5,000 hp. This power it is proposed to use for the operating of the important Realitos mining property located in the district of Andres del Rio, State of Chihuahua, which the United Mexican concern has just bought at a cost of some $2,500,000.

RICH COPPER IN MEXICO.—The official newspaper of the State of Mechoacan, Mexico, which is published under direction of the Governor, says that the most extensive and richest bed of copper ore in the world has just been discovered near the town of Tinguindon, in that State. The ore bed has been examined by mining experts, and it is said to cover an area of 125,000 acres. Fourteen veins have been located. One vein is 200 meters wide and more than 20,000 meters long, extending on the surface of the soil. The discovery was made by J. Ciceron Castillor, who has applied to the government for title to the property.

ELECTRIC RAILWAY FOR MEXICAN COPPER MINES.—The Greene Consolidated Copper Company, 377 Broadway, New York, is about to build an electric road between its Ronquillo mines and La Cananea, State of Sonora, Mexico. The distance is about 2½ miles. Power will be derived from the 2,100-hp plant which the company has just installed. Electricity is utilized to operate practically everything on the property. The engines are from the Union Iron Works, San Francisco. The generators are General Electric. The plant is expected to be added to in the near future.

EQUIPMENT FOR KEIHIN TRACTION COMPANY.—The Japanese house of Mitsui & Co., 445-447 Broome Street, has just placed a contract for trucks and motor equipments for use in the Keihin Traction Company's system, between Tokio and Yokohama. Ten trucks have been ordered from the Peckham Manufacturing Company. The General Electric Company secured the contract for motor equipments. Each truck will have four motors of 50-hp capacity. The car bodies will be built in Japan.

WATSON-STILLMAN MACHINERY FOR GERMANY.—The Watson-Stillman Company, 204-210 East Forty-third Street, New York, has secured a cable order from Germany calling for the shipment of twenty medium-sized hydraulic presses. Seventy presses are to be installed in the Glen Cove (N. Y.) plant of Fayerweather & Ladew, 91 Liberty Street, New York. With a view to securing larger capacity the Watson-Stillman people contemplate the erection of a large factory in New Jersey.

KELLOGG TELEPHONE STRIKE.—The strike situation at the factory of the Kellogg Switchboard & Supply Company, Chicago, is improving. Acknowledging their inability to force the company to accede to the demands of its striking employees, the teamsters have formally withdrawn from the struggle, and the former is again in a position to receive raw material and ship freight. The unions of all the trades involved in the strike have, however, decided to continue the present struggle; and the Federation of Labor has voted to assess its 300,000 members 5 cents each monthly while it runs the strike.

VARIOUS EQUIPMENTS FOR CHINA.—Fearon, Daniel & Co., of China, New York offices 90-96 Wall Street, received several orders by last mail for equipment for Shanghai for use in connection with the electric lighting system of the foreign settlements. The orders call for several standard motors of one and three hp; five machines for 25-light circuits; constant-current transformers; series-alternating arc lamps, with all accessories; portable indicating watt-meters, etc.

MONTEREY ELECTRIC TRACTION PROJECT.—The Mexican Mining & Exploration Company, whose head offices are in Washington, D. C., proposes to furnish the necessary capital for the construction of an electric traction system in the Mexican city of Monterey and vicinity. Later the system may be extended to a number of other small towns in the outlying regions. Power to operate the system it is proposed to derive from San Juan River.

LIGHTING A COUNTRY CLUB.—The Country Club, of Newton, Mass., believes in keeping up-to-date in respect to methods of illumination used. The beautiful quality of the light disseminated by the Nernst lamp, as well as the pleasing distribution, has resulted in the installation of a large number of single-glower Nernst lamps for lighting the club-house throughout, and great satisfaction is expressed with the results obtained by this innovation.

THE ISAAC LEISY BREWING COMPANY, of Cleveland, is making an interesting installation by replacing an old equipment consisting of 125-volt generators with a 100-kw and a 50-kw, Westinghouse 125-250-volt, three-wire engine-type generator. The change is being made to effect the double purpose of obtaining 220 volts for running the motors and 110 volts for use in connection with its arc and incandescent lighting.

THE NATIONAL MINING COMPANY, of Pittsburg, Pa., has recently added to its electrical equipment one 13-ton Baldwin-Westinghouse locomotive; two Westinghouse 200-kw, 500-volt, 200 r.p.m., engine type generators, connected to Buckeye engine; one Westinghouse 20-kw, 125-volt, 390 r.p.m. engine type generator, connected to Westinghouse standard engine, and the usual switchboard, etc.

ELECTRIC MACHINERY COMPANY, of Minneapolis, Minn., have been installing an electric light plant in the Donaldson Glass Block, that city. The dynamo they have built for the purpose is a direct-current, ten-pole, 110-120 volts, 100 r.p.m., with a normal capacity of about 500 hp. It was designed by Mr. James T. Boustead, superintendent of the company's mechanical department.

HYDRAULIC PLANT FOR MEXICAN MINES.—Contracts will shortly be let for the construction and equipment of a large hydraulic plant to generate energy to operate Las Dos Estrellas, one of the principal mines in the El Oro district, Mexico. The plant is to be built on the Cienega River, Tlalpujahua, close to the mines. The initial capacity of the plant will be about 1,500 hp.

GENERAL ELECTRIC EQUIPMENT FOR BURMAH RAILWAY SHOPS.—The General Electric Company has secured a contract for the electrical equipment of the Insein shops of the Burmah railways. The machinery will furnish energy for both light and power purposes. The "punkah" hand-driven fans are to be replaced by up-to-date Yankee electric fans.

ELECTRIC SUPPLIES FOR THE PHILIPPINES.—Paul S. Carter, the United States purchasing agent for the civil government of the Philippine Islands, is at present purchasing considerable quantities of electrical supplies, etc. His offices are on the fifth floor of the new Whitehall Building, New York.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, of Rochester, N. Y., and Chicago, Ill., has recently sold a 400-capacity new style generator call visual signal switchboard with complete protective apparatus to the Geiger Telephone Company, Churubusco, Ind.

General News.

THE TELEPHONE.

DENVER, COLO.—The Colorado Telephone Company's new headquarters on Champa Street have been opened.

DENVER, COLO.—The Colorado Midland Railroad is rapidly completing its private telephone system along the road. The line is now in operation between Denver and Leadville and will soon be in operation as far as Grand Junction.

DENVER, COLO.—In response to a request of the public utilities committee of the charter convention, the Colorado Telephone Company has submitted a report showing returns on invested capital. The report shows a capitalization of $5,000,000; issued capital, $3,400,000. The investment in plant and real estate up to January 1, this year, was $3,623.56; gross earnings for the year $1,083,037.43; expenses $771,231.34. The net profit for the year in this State was $311,806.09. The net earnings for the year upon the actual investment in the plant, says the report, was only a trifle over 9 per cent. This is taken as an argument against municipal ownership of public utilities.

SUEZ, ILL.—The Suez Mutual and Greenwood Telephone Exchange has 90 subscribers and four trunk lines. A new metallic switchboard is to be put in.

WARRENSBURG, ILL.—The Warrensburg Telephone Company has 200 subscribers and a 50-drop board. It has 100 miles of toll line, its rates being $12 per year.

RUSHVILLE, ILL.—The City Council has revoked the franchise of the Western Illinois Telephone Company and has ordered the company to remove its plant within ten days. The telephone company has employed counsel.

FLORA, ILL.—The new rural telephone line extending south-east of this city and covering portions of Clay and Wayne counties has been opened for business. The line which was built expressly for the farming communities will be followed by the construction of other lines, with Flora as the center of the system.

CORYDON, IND.—The Indiana Home Telephone Company has been granted a franchise over the highways of Harrison County.

EDINBURG, IND.—The Citizens' Telephone Company operates a 300-drop board, and has 280 subscribers and 28 miles of toll line.

LAPEL, IND.—Messrs. E. A. Tull & Co. operate the telephone station here. They have a 200-drop board with 200 subscribers. They purpose connecting all farms within a radius of four miles from town.

BROWNSTOWN, IND.—The Brownstown Telephone Company purchased this business last September and since then has added another 100-drop board and about 65 new subscribers. There are now a 200-drop board and 200 subscribers.

HALL, IND.—The Hall Mutual Telephone Company has a 25-drop board and 45 subscribers. The prospects are good as lines are being built all the time connecting with other lines giving patrons connections with about 2,000 telephones.

INDIANAPOLIS, IND.—The Central Union Telephone Company, which recently moved its general offices from Chicago to this city, is now running its shops and supply department from Chicago to a building on West Maryland Street, in this city.

EVANSVILLE, IND.—During the recent excitement and incidents relative to the riot that occurred in this city, the long-distance telephone company handled at least half of the business of correspondents of the newspapers in Indianapolis, Cincinnati and Louisville.

INDIANAPOLIS, IND.—The Carthage Telephone Company has filed articles of incorporation. It will build telephone lines and exchanges in Rush, Henry, Hancock and Shelby counties. The capital stock is $10,000. The principal office and exchange will be in Carthage. Van Hood, F. W. Cregor, L. A. Hood and M. A. Greager are the promoters.

TORRES, MEX.—A new telephone line has been constructed between this place and Campo Santo Nino.

CHIHUAHUA, MEX.—A movement has been inaugurated here looking towards the organization of a new telephone company to put in a telephone system in competition with that of the existing company.

CULIACAN, MEX.—An extensive telephone system is to be established in this state by a company which has been organized for that purpose. The first long distance line to be constructed will be between this city and the port of Mazatlan.

SALTILLO, MEX.—John Woessner, of this city, who is at the head of a syndicate which obtained a concession from the Mexican Government for the establishment of toll telephone lines and local exchanges throughout Mexico, says that good progress is being made in the construction work. The first section of the toll lines is now in operation between Torreon, Gomez Palacio and Lerdo and is being rapidly extended to Saltillo, Monterey and Durango.

PLAINFIELD, MICH.—The Michigan Telephone Company has a 10-drop board, three subscribers and five miles of toll line. The Rural Telephone Company and the Livingstone County Telephone Company are connected with this office.

PLAINVIEW, MINN.—The Greenwood Prairie Telephone Company has a 110-drop board and 300 subscribers, with 50 miles of toll line. The monthly rental is $1.00, $1.50 and $2.00.

MORRIS, MINN.—The Stevens County Telephone Company operates a 250-drop board at Morris; 25 at Hancock; 30 at Chokio and 25 at Cyrus, with 275 subscribers in all. There are 40 miles of toll line, and rural lines will soon be built.

MONTEVIDEO, MINN.—The Citizens' Telephone Company has a 300-drop board and 250 subscribers. It has recently built a brick central station and put in some cable, and is now building farmers' lines. As soon as present improvements are completed, 300 more subscribers are expected, there being a great demand for farmers' telephones.

PALMYRA, MO.—The Palmyra Telephone Company operates a 200-drop board, has 158 subscribers and 150 miles of toll line.

POPLAR BLUFF, MO.—The Poplar Bluff Telephone Company operates a 400-drop Eureka switchboard, with 400 subscribers. There are 35 miles of toll line.

SENECA, MO.—The Seneca Telephone Company operates a 110-drop board, with the same number of subscribers, and 50 miles of toll line. The rates are $12 and $24.

LA PLATA, MO.—The La Plata Telephone Company gives service to 175 subscribers at $12 per year. It has also 75 miles of toll line and operates a 200-drop board.

MOUND CITY, MO.—The telephone exchange here has doubled its capacity within the past year. It has a 200-drop board and 350 subscribers, city and party lines; also 10 miles of toll line.

LIPTON, MO.—The Lipton Telephone Company operates a 200-drop board, has 148 subscribers and 20 miles of toll line. Farmers' lines average 900 calls daily. The company intends rebuilding.

OREGON, MO.—The Oregon & Forest City Telephone Company operates a 200-drop board with 260 subscribers and 50 miles of toll line. A switchboard of 400 drop capacity is to be installed.

NOVINGER, MO.—The Novinger Telephone Company has a 200-drop board, 75 subscribers and 55 miles of toll line. Several more lines are to be built, and a great deal of work is projected for this season.

GALLATIN, MO.—The Daviess County Telephone Company gives good service to 500 subscribers and operates a 300 drop board. There are 80 miles of toll line. The territory hereabouts is pretty well covered.

LADDONIA, MO.—The Laddonia Telephone Company is now putting in a new metallic system, and building two farmers' lines. It operates a 100-drop board, has 65 subscribers and 16 miles of toll line. Rates are $15.

LEBANON, MO.—The Ozark Telephone Company has just increased its capital stock from $6,000 to $12,000, and is rebuilding and enlarging its exchange for an increase of 50 per cent. more business. It has a 200-drop board, 225 subscribers and 105 miles of toll line.

WEATHERBY, MO.—The De Kalb County Mutual Telephone Company has 100 subscribers and 600 miles of toll line, with four wires to the pole. The annual dues are $3. The company started with $5,000 capital. It now has $25,000 paid up, and has bought and placed 17 switchboards in De Kalb county. The main office is at Maysville, Mo.

PLYMOUTH, OHIO.—An ordinance has passed providing for an issue of $4,000 bonds for the purpose of building a municipal lighting plant.

ELYRIA, OHIO.—The Elyria Home Telephone Company has purchased a new building and will install a new central-energy board to accommodate 2,000 patrons.

CECIL, OHIO.—The Cecil Telephone Company has been incorporated with $10,000 capital stock. The incorporators are S. E. Demuth, W. A. Weaver, William Green, Boyd Randolph and C. H. Weaver.

BUCYRUS, OHIO.—Dr. J. A. Chesney has succeeded E. Blair as president of the Bucyrus Telephone Company. J. C. F. Hall has been elected secretary-treasurer and A. J. Unger, manager of the company.

LA RUE, OHIO.—The La Rue Telephone Company has been chartered under West Virginia laws, with a capital of $50,000. The incorporators are J. H. Leonard, C. F. Stoll, M. A. Taylor, W. F. Kniffin and W. F. Johnson, of La Rue.

JACKSON CENTER, OHIO.—The Jackson Center Telephone Company has increased its capital stock from $12,000 to $25,000. It is planning a number of extensions. W. H. Fledderjohann is president, and J. P. Zehner general manager of the company.

MT. VERNON, OHIO.—The Mt. Vernon Telephone Construction Company has been organized with $5,000 for the purpose of building telephone lines in Knox County. E. W. Breece, C. E. Painter, E. O. Arnold, P. S. Kelser and H. C. Devin are the incorporators.

DELAWARE, OHIO.—The Citizens' Telephone Company is planning extensions to its exchange. The company is building a large number of farmers' lines throughout the country and is installing branch exchanges at Lewis Center, Ostrander, Leonardsburg and other neighboring towns.

CLEVELAND, OHIO.—The Federal Telephone Company has extended its option on the stock of the Columbus Citizens' Telephone Company from July 1 to September 1. The option provided for the sale by the Federal Company of its holdings in the Columbus Citizens' to Columbus parties at $60 per share. The option also extended the right of the Federal Company to buy back 2,000 shares of the Columbus stock which was sold to Columbus parties some time ago at $45.

PIQUA, OHIO.—Representatives of the telephone companies in Champaign, Miami, Logan, Shelby, Darke, Auglaize and Union counties met at Piqua recently and formed an association for the purpose of perfecting better traffic arrangements for the handling of toll business in this district. These officers were chosen: L. M. Flesh, Piqua, president; C. H. Marvin, Urbana, vice-president; A. J. Hess, Sidney, secretary-treasurer. Another meeting will be held in Piqua in September.

EL PASO, TEX.—The Southern Independent Telephone Company will have its system here completed and in operation within ninety days.

SARATOGA, TEX.—The Beaumont-Northwestern Telephone Company is establishing a telephone exchange here. It will open about August 1 with 250 subscribers.

HOUSTON, TEX.—It is reported that the Southwestern Telegraph & Telephone Company has purchased the telephone system of the Citizens' Telephone Company in this city. It is stated that the latter company has ceased construction work.

SPOKANE, WASH.—The Trades Council has instructed all union men to order their telephones taken out unless the telephone company accedes to the demands of the striking telephone exchange girls.

SPOKANE, WASH.—Doerr, Mitchell & Co., are making an effort to secure a franchise for an independent telephone system in this city. It is proposed to place the wires underground and to extend the lines into the farming districts.

SPOKANE, WASH.—Being unwilling to submit to the company's rule forbidding the telephone operators to dispense with neck ribbons or to wear their hair low on hot days, eighty of the telephone girls have gone out on a strike. The trades council is assisting the girls and an effort is being made to have all the union men take out their telephones. The places are being filled by other girls and the service continues in operation.

ELECTRIC LIGHT AND POWER.

GADSDEN, ALA.—It is reported that Capt. W. P. Lay intends to utilize the water power developed on his recently purchased property on Wills Creek for furnishing electric power to Gadsden, Attalla and Alabama City. It is his intention to construct a plant on Big Creek to develop 500 horse power.

GRAND VIEW, ARIZ.—The Grand Canyon Company of this place has had estimates made on the cost of a power plant that may be established at Mooney Falls, on Cataract Creek, about forty miles from the mine. The establishment of an electrical generating plant for that place for the purpose of affording power for the operation of the mine here is contemplated.

MAYER, ARIZ.—The sub-station of the electric transmission line which is being built in this section by a company of which Mrs. I. E. Tutt is vice-president and general manager, will be located here. The proposed power plants of the company will be located on Fossil Creek, in Yavapai County. According to the statements of the promoters of the project 6,000 horse power is to be developed in two plants, one of 2,500-hp and the other of 3,500-hp. A number of tunnels, ditches and flumes are to be constructed. The transmission lines are to run to Mayer, Portland, Prescott, Jerome and other mining and industrial centers. The several lines will each be 50 to 75 miles long.

IDAHO SPRINGS, COLO.—The rate war that has been in existence in Idaho Springs for the last two years on incandescent and arc-light service is at an end. The fight has been between the electrical department of the Gem Extension Mines Company, Consolidated, and the Canada Electric Company which receives its power from the United Light & Power Company, of Georgetown. The competition brought the rates for incandescent lighting down to as low as 10 cents a month per incandescent lamp, but an agreement has now been reached and equitable rates restored.

BARNESVILLE, GA.—Bonds have just been sold, the proceeds to be used for an electric light plant and to improve the water works.

CONYERS, GA.—The question of constructing an electric light plant and water works is under consideration. John H. Almand is mayor.

BARNESVILLE, GA.—Bids will be received Aug. 3 by the City Council for furnishing apparatus and supplies for the municipal electric light plant, including one 100-kw alternating current generator, one exciter for same, one 150-hp high speed engine, one 150-hp Corliss engine, one 150-hp closed feed-water heater, etc. J. A. Blalock is City Clerk.

JERSEYVILLE, ILL.—A deed of trust for $15,000, given by the Jerseyville Light, Heat & Power Company to William Morgan Hand, has been filed.

PLYMOUTH, ILL.—The Plymouth Gas, Light & Fuel Company has been incorporated, with a capital of $30,000, by John B. Bowell, Prosper A. Ball, Chas. A. Wallace, and others.

ALTON, ILL.—The City Council has authorized the drawing of a ten-year contract with the Alton Railway, Gas & Electric Company for lighting the city streets. The proposition is to install 160 2,000-cp open arc lamps, at $69 per light per year.

WABASH, IND.—A. S. Maltby has submitted his report to Council on the proposed electric light plant. He estimates the cost of constructing a plant here as $41,000.

BURLINGTON, IA.—The Council has under consideration an ordinance providing for the placing of all wires underground.

GUTHRIE CENTER, IA.—The contract for the construction of the municipal electric light plant has been awarded to the Rock Island Electric Construction Company, of Rock Island, Ill. The plant will have a capacity of 2,000 lights and will cost $20,000.

DANVILLE, KY.—An election will probably soon be held to vote on the question of constructing an electric light plant to cost about $30,000.

VIDALIA, LA.—An election will be held to vote on issuing bonds for an electric light plant and water works.

WILLIAMSTOWN, MASS.—The trustees of Williams College are reported to be considering the construction of an electric light plant.

FALL RIVER, MASS.—The Board of Aldermen has passed an ordinance providing for the establishment of a municipal electric light plant.

FORD, MICH.—The Michigan Electric Company, of Detroit, has secured the contract for an electric light system for $3,337.

BADAXE, MICH.—Bids will be received July 30 by George W. Clark, Village Clerk, for $11,750 bonds for electric light and water works extension.

SAN BLAS, MEX.—H. B. Masset, who is said to represent a syndicate of California capitalists, has been investigating the situation here with the view of establishing an electric light plant and street railway system.

VICTORIA, MEX.—An American company recently sent a representative to this section to investigate the feasibility of establishing an electric power plant on some of the rivers that flow through the region between here and the Gulf coast. It is stated that an abundance of water power is available on some of these streams and that it is the intention of the company, if the report of its expert is favorable, to utilize this for generating electrical energy that will be supplied to this city and to mines and ranches for commercial and industrial purposes.

FT. SNELLING, MINN.—C. F. McBride, of St. Paul, is stated to have secured the contract for an electric light plant at $19,276.

MERIDIAN, MISS.—It is stated that the Meridian Light & Power Company will erect at once a new brick power house and install new machinery, at a cost of $100,000. The contract for boilers has been let. Ford, Bacon & Davis, 149 Broadway, New York, N. Y., are the engineers.

SEWARD, NEB.—The citizens have voted to issue $7,000 bonds for an electric light plant.

LINCOLN, NEB.—T. K. Craven, of Bloomfield, has filed with the State Board of Irrigation a petition for permission to use the waters of the Niobrara just above its confluence with the Missouri to develop power for street railways and electric lighting.

LAS VEGAS, N. M.—It is reported that the Las Vegas & Hot Springs Electric Railway, Light & Power Company proposes to construct a lighting plant at a cost of about $28,000.

AKRON, N. Y.—Contracts for lighting this village by electricity have been awarded to the Niagara Engineering Company, which will do the line construction work. The Ft. Wayne Electric Company will install the dynamos and station equipment.

PORT DICKINSON, N. Y.—The George O. Moon Power Company has been organized to build a dam across Chenango River at Port Dickinson, from which about 400-hp will be developed for the operation of an electric power and lighting plant for Port Dickinson and the furnishing of power for the mills and elevator of G. O. Moon & Co., Binghamton. Walter C. Moon is president.

BURLINGTON, N. C.—It was voted, July 14, to issue bonds for an electric light plant.

BURLINGTON, N. C.—The town of Burlington has voted $18,000 bonds for an electric light plant to be owned and operated by the city.

DAYTON, OHIO.—The Citizens Heat, Light & Power Company has applied for a franchise for lighting the streets of Dayton. H. J. Myers is president and general manager.

BAKER CITY, ORE.—The plant of the Baker Gas & Electric Company, which was recently destroyed by fire has been entirely rebuilt, including the installation of a new Nordberg-Corliss and 200-kw generator and the erection of a new building. The new plant was operating in 38 days from the time the old plant burned. T. B. Whitted, consulting engineer of Denver, Colo., had charge of the installation of the new equipment.

BAKER CITY, ORE.—The Rock Creek Power & Transmission Company has recently let contracts and is beginning the installation of a 1,000-hp water power plant on Rock Creek, 16 miles from Baker City. The plant will consist of two 400-kw three-phase alternators, driven by De Remer water wheels under a 940 ft. head, switchboard, step-up and step-down transformers and a 16-mile transmission line. Power will be supplied to the Baker Gas & Electric Company and to mines in the vicinity. Water will be carried to the power station through a 1¾ mile flume and a 2,600 ft. riveted pipe line. The transmission will be made at 22,500 volts over No. 6 bare copper wires. T. B. Whitted, of Denver, Colo., is the consulting engineer and contractor for the entire plant with the exception of the flume and building. It is expected that the plant will be in operation by January 1 next.

MONTREAL, QUE.—The Montreal Light, Heat & Power Company, which recently secured a monopoly of all the water power around Montreal by purchasing the Lachine Hydraulic & Land Company, announces that an increase in the price of electricity will be made. All existing contracts will be cancelled and when the new contracts are made a discount of only 10 per cent. will be allowed on one year contracts, and 15 per cent. on five-year contracts will be allowed instead of 33⅓ per cent. discounts.

TRENTON, TENN.—On August 12 the town of Trenton will vote on the question of issuing bonds to purchase the local electric light plant and put in an up-to-date system.

BRENHAM, TEX.—William Perry, general superintendent of the electric light plant here says that the plant is to be improved and its capacity increased.

WACO, TEX.—The preliminary steps have been taken looking to obtaining power from the Brazos and Bosque Rivers at points near here to be utilized in generating electrical energy to be distributed throughout Central Texas. The enterprise is being promoted by the Business Men's Club, of Waco, which is co-operating with the citizens of other localities of this region. The local committee which has charge of the matter consists of J. T. Davis, Bart Moore, R. T. Dennis, C. M. Hobby, T. N. McMullen, Jr., William Cameron and C. W. Hobson.

PALOUSE, WASH.—The City Council has granted D. G. Klinefelter, of Shelton, Wash., a 25-year electric light franchise.

NEENAH, WIS.—The Wisconsin Traction, Light, Heat & Power Company will petition the Council of Neenah and Menasha for electric light franchises.

INDEPENDENCE, WIS.—Contracts for constructing the electric light plant have been awarded as follows: Electric equipment to the Ft. Wayne Electric Works, Ft. Wayne, Ind., for $2,998, and steam plant to the Crowley Electric Company, Duluth, Minn., for $3,050.

THE ELECTRIC RAILWAY.

BIRMINGHAM, ALA.—Work has begun on changing the Powderly-Bessemer line of the Birmingham Railway, Light & Power Company from steam to electricity.

NORWICH, CONN.—It is reported that the controlling interest in the Norwich Street Railway Company and the Montville Street Railway Company, which has been held by Tucker, Anthony & Co., of Boston, has been purchased by Stillman F. Kelley, of that city.

ATLANTA, GA.—The committee on roads and bridges has recommended that right of way be granted to the Piedmont Electric Railway Company which proposes to build a road from Atlanta to Rosewell.

ROCKFORD, ILL.—The Interstate Electric Railway Company, of Rockford, has been incorporated, with a capital of $50,000. The incorporators and first board of directors are N. F. Thompson, M. A. Beal, E. H. Keeler, H. N. Starr, R. G. McEvoy, all of Rockford.

OTTAWA, ILL.—All the property of the Ottawa Railway, Light & Power Company has been sold to Rollins & Sons, the Boston bankers, who hold all the outstanding bonds of the company. The price paid was $160,000. It is understood that the purchasers will at once proceed to make many improvements in the road.

BELLEVILLE, ILL.—Articles of incorporation have been filed by the Southern Illinois Electric Railroad Company, capitalized at $50,000. The principal office of the company will be at Mount Vernon, Ill. The incorporators are J. R. Pierce, G. F. M. Ward, Sam Casey, Louis G. Pavey, Samuel T. Maxey and A. N. Johnson.

BLUFFTON, IND.—The Muncie, Hartford & Fort Wayne Interurban Railroad Company has bought ground to be used as a location for the power plant and car houses at Bluffton.

SOUTH BEND, IND.—The Hobart & Western Interurban Company, under the name of the Indiana Northern, has obtained a franchise through South Bend and St. Joseph County to the Laporte County Line.

INDIANAPOLIS, IND.—The Indianapolis & Southwestern Electric Railway, the new Martinsville line by the way of Waverly, is to be constructed by the Interurban Railway Construction Company, of Indianapolis, which has been incorporated, with $10,000 capital stock. F. E. Bakeman, W. S. Taylor, Mrs. Jean Brudi, W. G. Wagenhals and O. M. Murphy are the directors.

NEW ALBANY, IND.—The stockholders of the New Albany Street Railway Company, at their annual meeting, elected the following board of directors for the ensuing year: Samuel Insull, of Chicago; R. W. Waite, James W. Dunbar, Louis Hartman and Alexander Hartman, New Albany. Samuel Insull was elected president; Louis Hartman, vice-president; R. W. Waite, secretary and treasurer.

INDIANAPOLIS, IND.—Work on the Indianapolis, Danville & Rockville Traction Company's line, which will reach the Parke County coal fields, will begin this month, according to the announcement of President Fauvre, of the Indianapolis & Eastern, of which the new road will be an extension. The Danville Construction Company, which is to build the road, has been incorporated with $100,000 capital. F. M. Fauvre, John W. Chipman, Melford B. Wilson, Ansel Fatout and C. E. Morgan are directors. The distance between Indianapolis and Danville is 20 miles.

ARDMORE, I. T.—The Ardmore Coal & Power Company has applied to the City Council for a franchise to construct an electric railway here.

WICHITA, KAN.—The Arkansas Valley Interurban Railway Company has been chartered to build an electric railway from Wichita to Arkansas City. The total length of the line will be 83 miles. The main power station will be at Oxford, where it is believed there is sufficient water-power to run the whole line, unless it may be a month or two in summer, when they will possibly need a small steam plant as an auxiliary. The water-power is to be taken from the Arkansas River, which it is estimated will furnish 2,200-hp at ordinary low water, and 1,500-hp is the amount estimated to run the road. The company is capitalized at $1,000,000. The officers of the company are O. A. Boyle, president; William Allison, vice-president; J. E. Howard, secretary; C. L. Davison, treasurer. All the officers are residents of Wichita.

FRANKFORT, KY.—W. S. Louge, of Cleveland, Ohio, said to be representing Pennsylvania capitalists, has purchased a twenty-year franchise for the operation of an electric street passenger and express railway here.

THIBODAUX, LA.—It is said that work will soon begin upon the proposed third-rail electric railway between Thibodaux and Donaldsville and the important towns down the Gulf Coast. The road will be 124 miles long. C. P. Young is said to be the principal promoter of the project.

FITCHBURG, MASS.—The Leominster, Ayer & Shirley Street Railway will be built from North Leominster to Ayer this year. The line is nine miles long. It is also stated that the Lowell & Ayer Street Railway, in which the same persons are interested, will also be built this year.

MINNEAPOLIS, MINN.—Henry C. Hanke and Edwin J. Forster have petitioned the County Commissioners for a franchise for the construction of an electric railway from Minneapolis through Robbinsdale, Osseo and Champlin to Anoka. It is the intention of the promoters to connect with the Twin City Rapid Transit Company's line now running to Robbinsdale.

LINCOLN, NEB.—Articles of incorporation have been filed for the Sioux City, Homer & Southern Railway. The capital stock is fixed at $500,000, although the articles provide for an increase to $1,000,000. The incorporators are largely Sioux City and Omaha people, including Senator Joseph H. Millard, Postmaster Crow and J. B. Haynes, of Omaha; R. A. Talbot, of Sioux City, and R. S. Hall and C. J. O'Connor, of Homer.

CHARLOTTE, N. C.—It is reported that Washington, N. C., Kinston and Greenville will be connected by an electric railway and that Upshur & Co., of Philadelphia, will underwrite it.

ALBANY, N. Y.—The Albany & Hudson Railway Company has secured permission from the State Railroad Board to issue $150,000 in bonds for making improvements to its line.

ALBANY, N. Y.—The opposition to the building of the Albany-Catskill Electric Railroad has been withdrawn. The road will begin construction next Spring. The distance is about 35 miles.

NEW YORK, N. Y.—The contract for sinking the Weehawken shaft of the Hudson River Tunnel of the Pennsylvania Railroad has been filed in the Hudson County Clerk's office at Jersey City. The contracting parties are the Pennsylvania and New Jersey & New York Railroad Companies and the United Engineering & Construction Company, of New York. The work is to be completed by Dec. 8, 1903, the contractors to forfeit $250 for each day's delay.

ROCHESTER, N. Y.—The Monroe County Belt Line, owned by the Rochester, Syracuse & Eastern Railroad and built through the village of Fairport, has elected officers as follows: Andrew H. Brown, president; De Witt C. Becker, vice-president; Merton E. Lewis, secretary; Percy R. McPhail, treasurer; Andrew H. Brown, of Despatch; Percy R. McPhail, Charles T. Chapin, Merton E. Lewis, of Rochester; William Nottingham, of Syracuse; Walter A. Paroe, of Fairport, directors.

COHOES, N. Y.—At a meeting held at Crescent, N. Y., for the purpose of forming an electric railway company to connect Schenectady and Cohoes by trolley the following board of directors was selected: William K. Mansfield, E. H. Stiles, D. C. Fry, Peter Smith, Freeman Guyer, James A. Buck, E. H. Shear, R. E. Dedrick, C. L. Van Slyke. Subsequently the board of directors elected the following officers: President, James A. Buck; vice-president, Wm. K. Mansfield; secretary and treasurer, R. E. Dedrick. Steps will be taken at once to secure the right of way and franchise, and it is expected that active operations will be commenced in the near future.

DAYTON, OHIO.—The Lebanon & Franklin Traction Company has increased its capital stock from $10,000 to $160,000.

DAYTON, OHIO.—The Dayton & Southern Railroad Company has increased its capital stock from $10,000 to $150,000. M. L. Mourer is president and F. E. James, secretary.

COLUMBUS, OHIO.—The Scioto Valley Traction Company has increased its capital stock from $1,000,000 to $3,000,000. W. F. Burdell is president of the company, and E. R. Sharp, secretary.

LOGAN, OHIO.—The Lancaster, Logan & Nelsonville Traction Company has filed papers of incorporation with a capital stock of $10,000, the incorporators being A. Magoon, J. W. Jones, D. A. Bannells and others.

TOLEDO, OHIO.—The Findlay, Fort Wayne & Western Railway has been sold at Master's sale at Ottawa to Judge J. J. Moore, of New York, who, it is said, represented the Cincinnati, Hamilton & Dayton Traction Company, which has been in control of the property for the past year.

CLEVELAND, OHIO.—The Kingsville & Southern Railway Company, of Cleveland, has been incorporated, with $20,000 capital stock, by E. F. Pegg, L. E. McAuley, F. M. Nowak, C. W. Sailtzer and Thos. H. Bell. The company plans to build an electric railway from Kingsville to North Kingsville.

NAZARETH, PA.—The Town Council has granted a franchise to the Easton & Belvidere Electric Railway Company.

HUMMELSTOWN, PA.—The Borough Council has granted a franchise to the Palmyra & Hummelstown Electric Railway Company.

SCRANTON, PA.—A route has been surveyed for an electric railway from Scranton to the summit of Bald Mountain, and a charter will soon be applied for. Local capitalists are backing the venture.

POTTSTOWN, PA.—It is reported that the Pottstown & Reading Street Railway has closed all contracts for material, and that the construction of the road, which will form the connecting link by electric railway between Philadelphia and Reading, will be started at once.

CORRY, PA.—The Erie, Cambridge, Union & Corry Traction Company has purchased the abandoned Clark & Warren refinery site, where its power house and car houses will be built. This road has accepted the local franchise, and cars will probably be running between Corry and Erie by July, 1904.

LEGAL.

TELEPHONE TAXES.—In a recent case before the Supreme Court of New Hampshire, between the New England Tel. & Tel. Co. and the city of Manchester, it was held that real estate owned by a telephone company and used in its ordinary business is not subject to taxation by the town in which it is situated; being already taxed by the state board of equalization. In 1901 the state board of equalization, acting under chapter 64 of the Public Statutes, determined the value of the plaintiff's property in this state for purposes of taxation to be $320,000, and assessed a tax thereon of $5,408, which sum was paid to the state treasurer. In the same year the assessors of Manchester assessed a tax upon the plaintiffs' real estate on Concord Street, and payment of the same was demanded. A petition for abatement was seasonably filed and denied. March 8, 1902, the plaintiffs under protest paid to the city the sum of $256.26, as the amount of the tax and interest thereon.

NEW INDUSTRIAL COMPANIES.

THE ELECTRIC RUBBER MANUFACTURING COMPANY, of Jersey City, has been incorporated, capital, $1,000,000. Incorporators: Charles H. George, Smith J. Mullin, William O. McCarthy.

THE ST. LOUIS AUTOLECTRIC COMPANY, St. Louis, Mo., has been incorporated with a capital stock of $4,000, fully paid. The shareholders are S. H. Wheelhouse, E. V. P. Ritter and R. F. Goodnow.

THE GILL ELECTRIC COMPANY, of New York, has been incorporated with a capital stock of $100,000. The directors are C. P. Gately, of Mamaroneck; E. R. Gill, of Yonkers, and C. D. Wood, Jr., of Brooklyn.

THE LAMPSON ELECTRICAL INDICATOR & ADVERTISING DEVICE COMPANY, of New York, has been incorporated with a capital of $25,000. Directors: R. D. Lampson, Meyer Michael and E. C. Stoddard, New York.

THE WORLD'S FAIR AUTOMOBILE COMPANY filed articles of incorporation at St. Louis, with a capital stock of $600,000, full paid. Thomas J. Hoolan, Charles M. Polk, T. J. Flanagan, Lawrence W. Day, Spence L. Finley, A. L. V. Mueller, James C. Espey, James Axtell, Michael Hurst, Charles Vastine and H. E. Simon are the incorporators.

THE ZAHN ELECTRIC COMPANY, located at 203 North 11th Street, St. Louis, Mo., has been formed with a capital of $5,000, paid up. Mr. William G. Zahn is president and general manager, Mr. William E. Howard, secretary. The company was incorporated for the purpose of buying and selling electrical machinery and supplies and doing a general contracting business.

OBITUARY.

MR. RALPH LAZARUS, of Columbus, Ohio, a director in both the local electric lighting and street railway companies died in that city on July 25. He was 52 years of age and as a hotel manager and business man had acquired a large fortune.

MR. R. H. FOERDERER.—Congressman Robert H. Foerderer, of the Fourth Pennsylvania District, died at his home in Torresdale, a surburb of Philadelphia, on July 26. He had been ill for some time from a complication of diseases. Mr. Foerderer was born in Germany in 1860 while his parents were sojourning in Europe. He was elected to the Fifty-seventh Congress as a Congressman-at-Large and re-elected to the Fifty-eighth Congress from the Fourth District of Philadelphia. He was a large manufacturer of leather and was president of the Keystone Telephone Company, of Philadelphia, whose large independent system has been described in these pages. He was also very greatly interested in electric traction developments in Philadelphia.

MR. C. A. MORSS.—Advices from Boston, Mass., state that Mr. Charles Anthony Morss, president of the Simplex Electrical Company, died suddenly on July 27, of heart disease. He was born in Boston on October 15, 1822, and his ancestors on both sides were among the original Puritan settlers of Newburyport. Soon after leaving school Mr. Morss entered the wire business with a firm occupying the same Cornhill Building which for nearly sixty-five years had been his own headquarters. He was identified with the Old South Church as a member of its standing committee. His wife and four sons survive him. For many years past he has been through the Simplex Company identified prominently with electrical wire insulation and electric heating interests.

MR. GEORGE A. COOKE.—We regret exceedingly to record the death at Oak Park, Chicago, of Mr. George A. Cooke, son of Mr. and Mrs. W. J. Cooke. This promising young engineer, whose father is so well known in the electric and street railway field from his connection with the McGuire Truck interests in Chicago, was brought up at Oak Park in the public and high school. Deciding to obtain training as a mechanical and electrical engineer he then began a special course of training in Chicago, and later pursued a course at Purdue University. With characteristic energy and ambition he immediately began what he hoped to make his life work, with the Westinghouse Company, and for a time was located at Toledo, Ohio, the former home of his family, in the construction of an electric railway where he had a great deal to do with the construction of the feeder conduits, etc. From overwork and exposure his health became impaired. After spending a winter in Florida he seemed entirely restored, and resumed work in Toledo, where he met with signal success. As the result of a severe cold he was compelled to go to Arizona for a winter. Later he went to California, and then for a year to Honolulu. During these years, while seeking restoration by change of climate, he persisted in business activity, engaging in the installing of mining and electrical apparatus. After a severe illness last winter he went back to Oak Park, and for five months made a brave fight for life. He was a fine type of young American manhood with all its capability, push, energy, cheerfulness and determination to win. He was a member of the First Presbyterian church, and leaves a wide circle of friends who mourn his loss and extend heartfelt personal sympathy to the bereaved parents and sister.

PERSONAL.

MR. FREDERICK C. MOTT has taken charge of the Eastern office of the American Conduit Company at 170 Broadway, New York.

MR. GEORGE YOUNGMAN has gone into the electrical supply business at Portsmouth, Ohio, and will do general electrical contracting work.

GENERAL A. W. GREELY, head of the U. S. Signal Corps, has sailed for Berlin to attend the international wireless telegraph conference at Berlin on August 4.

MR. GEORGE L. COLGATE, electrical engineer, resigned recently from management of the Batavia, N. Y., electric lighting system, and has been visiting New York City in regard to various engineering matters.

PROF. A. J. WOOD, of Delaware College, Newark, Del., has been visiting friends in New York and vicinity and making arrangements for lecture courses, etc. A new power plant is being put up at the College, and probably current will be received from one of the new transmission plants within the state.

MR. JAMES S. FEARON, head of the house of Fearon, Daniel & Company, of China, New York offices 90-96 Wall Street, which concern purchases considerable electrical equipment, supplies, fans, etc., for the Far East, particularly for shipment to the Shanghai municipal council, is now on his way to New York from China. He is expected to arrive here about the middle of next month.

PROF. A. E. KENNELLY, head of the electrical department of Harvard University, was married on July 22 to Miss Julia Grice, at Boston, Mass. They are now upon their honeymoon trip somewhere on the North American continent and will be at home after November 1 at 12 Hawthorne Street, Cambridge, Mass. A host of friends and admirers extend their heartiest congratulations and good wishes.

MR. J. L. CONWAY, who has been in charge of one of the divisions of the construction work for the Guanajuato Power & Electric Company, has taken a position with the Mexican Light & Power Company. This concern, it will be recalled, is to build an initial plant of 28,000-hp capacity at Necaxa for the purpose of developing current for transmission to Mexico City, some 90 miles distant. Mr. F. S. Pearson is primarily interested. The New York offices of the company are at 29 Broadway.

MR. U. N. BETHELL.—It is announced that James E. Mitchell, president of the Bell Telephone Company of Philadelphia since 1895, has tendered his resignation at a special meeting of the board of directors last week. Mr. U. N. Bethell, of New York, was elected to succeed him in this important capacity. Mr. Bethell is general manager of the New York Telephone Company and before being given charge of the Philadelphia territory was entrusted with that of the Potomac Bell Company. Not many years ago Mr. Bethell was a government clerk in Washington studying hard at law in his spare hours.

MR. J. K. ROBINSON, of Iquique, Chili, who represents the Westinghouse interests in Chili, etc., and who has been in the States for several weeks past, sailed for Colon July 27, but expects to return to New York within a fortnight. He went south so as to meet his wife and family who have left Chili owing to the plague. They will come back to New York with him. Shortly after his arrival here he expects to place further important contracts for the electrical equipment of Chilian nitrate plants. Mr. Robinson, while here, will make his headquarters at the offices, 116 Broad Street, of the William E. Peck Company.

MR. JAMES H. WHITE, one of Thomas A. Edison's foreign representatives, is recovering from an operation performed at the Orange Memorial Hospital by Dr. William Graves, of East Orange, which consisted of the removal from his skull of a piece of glass a quarter of an inch thick and about half an inch square. It became lodged there over three years ago, while Mr. White was superintending a reproduction of the battle of Spion Kop on Orange Mountain for an Edison moving picture machine. Mr. White acted as a Boer general and during the fight a bottle of powder exploded and showered him with fragments of glass.

MR. CLOYD M. CHAPMAN, who has been developing Thomas A. Edison's dry gold separating process, has gone to Australia to install a separating plant there. When the news of Mr. Edison's separator was announced, it was read by an Australian mining engineer in San Francisco, who was in this country to secure mining machinery. Mr. Edison's scheme appealed to him; he visited the plant in West Orange, and as a result a separator was built for him and shipped to Australia. London engineers who have tested the gold deposits upon which the separator is to work are said to think that they may prove to be the greatest in the world.

MR. ADOLPH M. BARRON, a well-known consulting engineer, at present the president of the New Albany Water Works Company, of which he is also a director, as well as being interested in an official way with a Chicago syndicate of power, light and heating interests at Jeffersonville, Franklin, Worthington and Bloomington, Ind.; St. Ann, Mt. Vernon and other points in Illinois, finds South Bend not central enough for operations. He has left for Indianapolis at the syndicate's request, to make that a center for operations. From there, among other things, he will direct the location and erection of a central power plant at some of the great bituminous coal mines, which will utilize the slack and refuse coal, too small to be utilized in shipment. This fuel will cost but very little, there will be no transportation charges and great results are expected. Power will be furnished at a radius of 100 miles it is is said.

MR. J. S. BADGER, general manager of the Brisbane Tramways Company, Brisbane, Australia, is visiting the United States. As many of our readers will recall, he was one of the pioneers in the electric railway business in this country, and supervised the installation of a number of the early roads for the Sprague and Edison companies. He went to Brisbane from Schenectady, N. Y., about seven years ago to install an electric tramway system in that city, and was appointed general manager. He left Brisbane on May 18 as a delegate to the Fifth Annual Convention of the Chambers of Commerce of the British Empire from the Brisbane Chamber to attend the Convention in Montreal, September 17 to 20. He also expects to attend the convention of the American Street Railway Association in Saratoga. Later on he proposes to visit London, where are the headquarters of the Brisbane Tramways Company. He will then return to Brisbane via New York.

COL. N. H. HEFT.—Taking a step already forenoted in these columns, Col. N. H. Heft has resigned from the presidency of the Stamford Street Railroad Company, which is owned by the New York, New Haven & Hartford Railroad, and the directors elected H. M. Kochsperger as his successor. Col. Heft will resign also from the presidency of the Meriden Street Railroad, which is controlled by the Consolidated, and again Mr. Kochsperger is to be chosen to succeed him. The action taken means that there is to be a closer union in operation between the New Haven Railroad system and the street railway lines it controls. Col. Heft's retirement is due to a desire for a long vacation in Europe. He retains his interest in the New York & Stamford Railroad Company, of which he is a director. Col. Heft is the originator of many extensions and improvements which are now under advisement, including an arrangement whereby the Consolidated will operate an electric suburban system from New York to Stamford, having trains from there to connect with the elevated system at 129th Street and the subway at 177th Street. He has had a great deal to do with pioneer third rail work in this country.

EDUCATIONAL.

STANFORD UNIVERSITY, CAL.—Prof. F. G. Baum, of Stanford University, California, reports that this year's electrical graduates there are: A. S. Kalenborn, who has secured a position with Westinghouse, Church, Kerr & Co., New York; A. J. Pahl, with the Westinghouse Co., at Pittsburgh; J. P. Jollyman, with the Valley Counties Power Co., at Ninishen, Butte Co., Cal.; A. O. Austin and R. J. Hughes with the General Electric Co., at Schenectady.

LEHIGH UNIVERSITY.—The department of physics and electrical engineering at Lehigh University has been re-organized with Prof. W. S. Franklin in charge of physics and Prof. W. Esty in charge of electrical engineering. Prof. Franklin is a graduate of the University of Kansas of the class of '87 and pursued graduate study in physics at the University of Kansas, at the University of Berlin, at Harvard University and at Cornell University. He was five years in charge of physics and electrical engineering at Iowa State College and he has been for six years in charge of physics and electrical engineering at Lehigh University. Prof. Esty is a graduate of Amherst College, of the class of '89, and of the Mass. Inst. of Technology of the class of '92. He was one year with the General Electric Company, at Lynn, Mass., and eight years at the University of Illinois as instructor and as assistant professor of electrical engineering, and he has been two years assistant professor in the same capacity at Lehigh.

LEHIGH UNIVERSITY.—The following are the graduates at Lehigh University in 1903, in electrical engineering, with the positions taken by them: J. J. Cort, Interborough Ry. Co., New York City; A. J. Diefenderfer, Electrical Inspection Bureau, New York City; S. W. Goldschmidt, General Electric Co., Lynn, Mass. C. B. Graham, Westinghouse, Church, Kerr & Co., Ry. Dept.; C. F. Hinckle, Jr., General Electric Co., Schenectady, N. Y.; R. Hunt, Consolidated Light, Ry. & Power Co., Wilmington, N. C.; C. E. Marks, General Electric Co., Schenectady, N. Y.; C. L. H. Ruggles, Capt. Ordinance Dept., U. S. A., Watertown Arsenal; R. N. Skillman, Fort Wayne Electric Works, Fort Wayne, Ind.; N. A. Wolcott, Electrical Engineer of the New York & Ohio Co., Warren, O. The past year has been a prosperous one for the department. It has been able to add by purchase and by gift a large number of new dynamos, motors, transformers, and meters to its equipment. The alumni have been more than usually active in co-operating to replace the apparatus and library destroyed by fire three years ago.

Trade Notes.

THE MARION INSULATED WIRE & RUBBER COMPANY, Marion, Ind., has completed plans for the erection of a new factory.

NERNST LAMPS.—Some time ago Swift & Company made a trial test of the Nernst lamp in their temporary office buildings. This test has proved so satisfactory that they are now installing about seven hundred of these illuminants, of the three-glower type, in their new office building at the Union Stock Yards, Chicago.

THE IDEAL ELECTRIC & MANUFACTURING COMPANY, recently organized at Mansfield, Ohio, to manufacture electrical goods, has commenced work on a factory building 100 x 65 feet and two stories high. Later it will build a power house.

STORAGE BATTERIES FOR ISOLATED PLANTS.—The application of storage batteries to isolated plants is the subject of Bulletin No. 79 recently issued by the Electric Storage Battery Company, Philadelphia. The particular plant represented in this bulletin is that in the Ferguson-McKinney Building in St. Louis, Mo. The subject is well illustrated with large half-tone cuts.

CONNECTICUT TELEPHONES.—Owing to the increased demand for "Connecticut" apparatus, the Connecticut Telephone & Electrical Company, Inc., of Meriden, Conn., has been obliged to print another edition of its new catalogue. This company has just purchased a new building in order to enlarge its capacity, which became necessary owing to the increasing demand for its products.

THE HELIOS-UPTON COMPANY has moved to Garden and Bridge Sts., Bridesburg, Philadelphia. It has obtained possession of a large and commodious plant and will consolidate its Chicago and Peabody factories with the Philadelphia factory, which was formerly at 1229 Callowhill St. This new arrangement will give the company superior facilities for manufacturing its line of arc lamps, storage batteries, telephone protectors, switches, etc.

DIRECT CURRENT ENGINE TYPE GENERATORS.—Circular No. 1033 of the Westinghouse Electric & Mfg. Company, is devoted to direct current engine type generators for lighting and power. The illustrations show the various parts in detail, and complete machines as set up for operation. The final pages give complete dimensions of machines ranging from 5¼-kw to 1,050-kw.

THE L. B. ALLEN CO., of Chicago, manufacturer of soldering sticks, soldering paste, salts, etc., and maker of commutator compound, has issued a very neat reminder of itself in the form of a 12-inch rule on folding cardboard. It is a very convenient device for those who have frequent use for a rule and desire one that will go into the pocket.

GERMAN ELECTRIC HOISTS.—The Gesellschaft fur Elektrische Industrie of Karlsruhe, Germany, sends us two catalogues relating to electrical hoists, which are excellent specimens of trade publications. The text and numerous illustrations are printed on toned backgrounds, the text in the more comprehensive catalogue being in German, French and English in parallel columns. An unusually extensive line of cranes is made by this company, both for direct and alternating current and all details appear to have been worked out with great skill.

STRUCTURAL IRON WORK.—In a 24-page catalogue, just issued, the Berlin Construction Company, Berlin, Conn., gives 20 full-page half-tone views of structures erected by it. Each illustration typifies a distinct class of structural work. The list embraces buildings of a large variety, roofs and bridges. The final pages of the catalogue contain a partial list of the company's customers. Besides its facilities for manufacturing steel work for buildings and bridges of all descriptions the company is prepared to contract for the design and erection of complete plants, ready for the installation of machinery.

TOWER-BINFORD ELEC. MFG. CO., Richmond, Va., has issued an excellent and surprisingly large catalogue of its products. It has 68 pages, and all the articles shown are of its own manufacture with the exception of the I. T. E. circuit breakers and the D. & W. renewable plug fuses, cases and cartridge fuses—which fit in with the other lines. Among the novelties and improvements shown are the Regina knife switch, the tank alarm, theatre switchboards, panel boards and other switches, all of which have some new feature of design or construction. These products are illustrated in the catalogue and are seen to be well thought out and of substantial construction.

LONDON TRANSPORTATION.—Every American city is interested in the solution of London's greatest problem—the question of transportation, the daily handling of its millions of street car passengers. How the London County Council, backed by a Royal Commission, is grappling with the problem of locomotion, seeking a wise adjustment of surface traffic and underground systems, is a story full of suggestion to every other great municipality in the world. The record of past methods and of achievement up to date is fully set forth by F. A. Acland, in *The Booklovers Magazine* for August, together with an account of large ideas projected or already in process of realization. Numerous illustrations and a map of Central London's underground system help to make the situation clear.

AIR BRAKE EQUIPMENTS.—The Westinghouse Traction Brake Company reports the following sales of street car air brake equipments, all being provided with motor-driven compressors. Five equipments to Evansville & Princeton Traction Co. Seven equipments to Wooster & Southbridge St. Ry. Co. Eight equipments to Concord & Manchester St. Ry. Co. Twelve equipments to Concord Street Railway Co. One equipment to Holland Palace Car Co. for use on electric sleeper. The company has also recently equipped a number of cars with its magnetic brake and car heating apparatus. The following is a list of some of the roads to whom this apparatus has been sold: Pennsylvania & Mahoning Valley Ry. Co., of New Castle, Pa., equipments for 16 cars. Morgantown Electric & Traction Co., equipments for 12 cars. Washington & Canonsburg Ry. Co., Washington, Pa., equipments for 15 cars. Altoona & Logan Valley Electric Ry. Co. equipments for 8 cars.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JULY 21, 1903.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

733,468. ANNUNCIATOR; Francis W. Dunbar, Chicago, Ill. App. filed May 27, 1901. (See page 184.)

733,643. ELECTROLYTIC APPARATUS; Leo Gurwitsch, Kiew, Russia. App. filed Nov. 10, 1902. (See page 185.)

733,782. TELEPHONE-LINE CONTACT APPARATUS; Joseph P. Werner, Cliftonforge, and William H. Silvey, Lowmoor, Va. App. filed Feb. 21, 1903. (See page 184.)

733,948. MAGNETO-ELECTRIC MACHINE; Daniel Drawbaugh, Eberlys Mill, Pa. App. filed Jan. 12, 1903. The machine embodies an automatic cut-out which breaks the circuit at the point in the rotation of the armature where the potential is at the maximum; it is designed to avoid the use of Rhumkorff coils for sparking purposes.

733,951. CURRENT REGULATOR; James P. Erie, New York, N. Y. App. filed Dec. 9, 1901. Means for breaking the circuit simultaneously at a number of points in series, thereby distributing the sparking over a number of points and reducing it at a particular pair of contacts where sparking is undesirable.

733,952. BRUSH SUPPORT; James P. Erie, New York, N. Y. App. filed Dec. 9, 1901. Details.

733,971. LIQUID RHEOSTAT OPERATED BY COMPRESSED AIR; Koloman De Kanto, Budapest, Austria-Hungary. App. filed May 25, 1901. A throttle valve which controls the pressure of air operating a rheostat, is itself automatically controlled by the current in circuit with the rheostat.

733,977. MASSAGE APPARATUS; Francis G. Lagerstrom and Andrew G. Anderson, Salina, Kansas. App. filed March 30, 1903. A hollow rolling sphere containing a battery whose poles are connected with various insulated segments in the surface of the sphere.

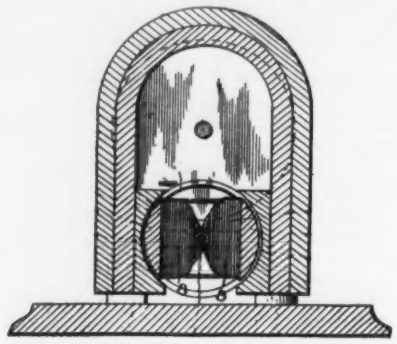
733,997. SAFETY DOOR SWITCH; Elden R. Renfrow, St. Joseph, Mo. App. filed Nov. 26, 1902. A connection between an elevator door and an electric switch rendering it impossible for the door to be open and the car at the same instant in motion.

734,046. RETURN CURRENT CIRCUIT BREAKER; Cummings C. Chesney, Pittsfield, Mass. App. filed July 18, 1902. A mechanism is used which is entirely controlled by currents flowing in the main distribution circuit and is entirely independent of the electromotive force upon the line, thus avoiding the use of a potential transformer or a shunt circuit on high potential systems.

734,053. THERMOSTATIC ALARM; Jules E. Fortin, Montreal, Canada. App. filed Nov. 20, 1902. A liquid is confined in one end of a pivoted tube by the fusible plug; when the plug is melted, the liquid flows to the opposite end causing the tube to swing on its pivot and close an alarm circuit.

734,090. GUARD FOR FLEXIBLE CONDUCTORS; George R. Pimlott, Chicago, Ill. App. filed June 25, 1902. A bell-shaped collar attached to an incandescent lamp socket to prevent sharp bends in the flexible conductor and also serving as a trap for moisture.

734,098. ELECTRIC SWITCH; John J. Ruddick, Newton, Mass. App. filed Oct. 15, 1900. A trolley wire switch consisting of a box applied to the wire and containing the switch mechanism from which a tappet projects into position to be struck by the wheel to throw the switch.



733,948.—Magneto Eectric Machine.

734,178. MOTOR CONTROL; John D. Ihlder, Yonkers, N. Y. App. filed Sept. 9, 1902. Controlling means for an elevator motor connected to operate under control of the armature potential for de-energizing the series field when the motor reaches substantially full speed.

734,197. INDUCTION COIL; Charles F. Splitdorf, New York, N. Y. App. filed May 19, 1903. The secondary is divided into two separate coils spaced apart and embracing the primary, each coil being housed in a separate casing.

734,227. GUARDING APPARATUS FOR VEHICLES OR MOVABLE STRUCTURES; Isaac Frank and Joseph Hutchison, New York, N.Y. App. filed Jan. 24, 1903. An electrical alarm apparatus placed upon a vehicle to indicate when the vehicle is being carried away by unauthorized persons.

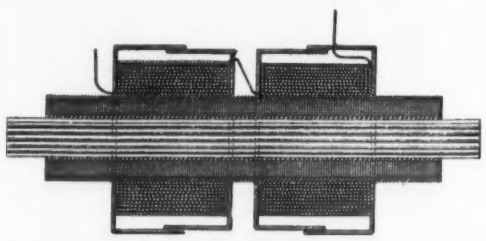
734,267. CONDUIT THREADED DEVICE; Arthur H. Knott, Milwaukee, Wis. App. filed Dec. 18, 1902. Details.

734,297. PAPER FEEDING MECHANISM; John Burry, Ridgefield Park, N. J. App. filed April 13, 1900. Paper feeding mechanism for printing telegraphs consisting of a spring-actuated feed device and variable escapement mechanism for controlling the rotation of the paper holder in order to give a uniform feed.

734,298. ELECTRIC ILLUMINATION FOR RAILROAD CARS; Max Buttner, Deutsch Wilmersdorf, Germany. App. filed April 25, 1902. A train lighting system in which a resistance in series with the lamp is maintained at such a temperature that any increase in the current causes a corresponding increase in the resistance and thus maintains a constant candle power.

734,305. PROCESS OF PRESERVING BEER; Francisque Crôtte, New York, N. Y. App. filed Jan. 19, 1900. (See page 185.)

734,310. COIL FOR DYNAMO ELECTRIC MACHINES; Hermann F. T. Erben, Schenectady, N. Y. App. filed April 19, 1902. Heavy field coils are built up of flat wire wound edgewise and with their terminals bunched and secured together.



734,197.—Induction Coil.

734,312. APPARATUS FOR THE ELECTROLYTIC DECOMPOSITION OF ALKALI CHLORIDS; Charles Fournier, Geneva, Switzerland. App. filed June 25, 1902. (See page 185.)

734,341. ELECTRIC SIGNAL; Henry L. Lee, Timpas, Colo. App. filed Aug. 5, 1902. A circuit closed for a railway signal constructed to be applied at any desired point to the rail and embodying a tappet which is struck by the car wheel to close the circuit.

734,353. ELECTRIC CLEANING KNIFE; Frank Nettleton and Edward R. Dempsey, Philadelphia, Pa. App. filed Feb. 24, 1903. A handle carrying an electrically heated blade to be used for burning off the fur and hair from hides and skins.

734,366. ELECTRIC CLOCK; Henry Rempe, Danville, Pa. App. filed July 2, 1902. Details.

734,369. MEANS FOR TRANSMISSION OF MOTION OR ROTATING PARTS; Carl F. Rodde, Berlin, Ger. App. filed Nov. 24, 1899. Mechanism for transmitting rotary motion comprising a rotary member, a plurality of circuits, means for impressing upon one of said circuits dependent upon the position of the rotary member, oppositely directioned currents of different potentials, means for suppressing the currents in one direction, and mechanism for translating the resulting unidirectional current into rotary motion proportional to the movement of said rotary member.

734,387. ELECTRIC HAMMER; Albert J. Woodworth, Sparrows Point, Md. App. filed Nov. 6, 1902. The momentum of the hammer on its upward stroke is utilized to produce the initial motion of the hammer on its downward stroke and electrically controlled means are used to accelerate the hammer and increase the rapidity and force of the blow.

734,389. SECONDARY ELECTRIC CLOCK; Theodore H. Wurmb and Robert Baumann, St. Louis, Mo. App. filed May 11, 1903. Details.

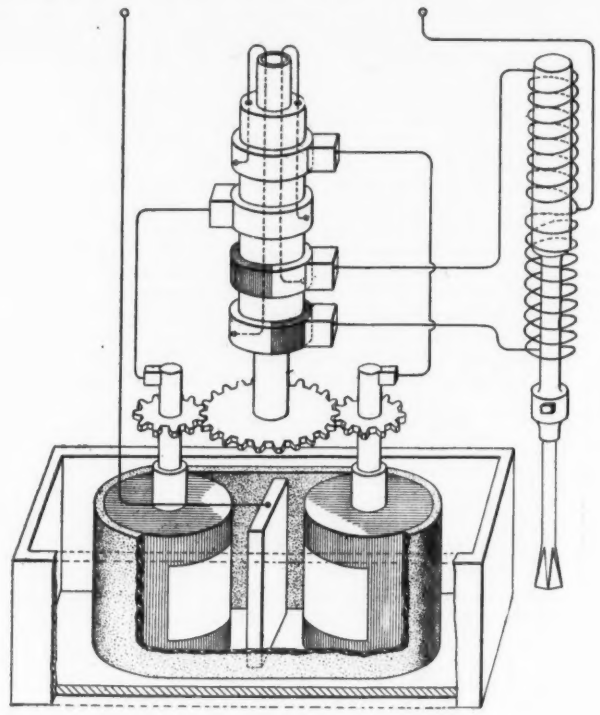
734,402. ROTARY EXTENSION BELL SWITCH; George E. Cork, Packerton, Ind. App. filed Sept. 6, 1902. A switch applied where two telephone lines terminate and only one telephone and an extension bell are in use, the purpose being to switch the telephone to either line and keep the extension bell on the line to which the telephone is not connected.

734,407. CIRCUIT TERMINAL FOR FUSES; Louis W. Downes, Providence, R. I. App. filed March 21, 1903. Details of a clamp to hold the end of the fuse tube.

734,424. COMMUTATING AND CURRENT SHAPING DEVICE; Frederick H. Loring, Chester, England. App. filed March 4, 1903. An apparatus for shaping or modifying the form of an electric current comprising a conducting fluid, electrodes and an insulating body immersed therein and adapted by their relative movements to periodically vary the area of electrode surface exposed to the fluid and thereby vary the current.

734,438. VOLTAGE REGULATOR; Charles E. Skinner, Wilkinsburg, Pa. App. filed Nov. 13, 1902. A main transformer one of whose windings has a plurality of leads extending therefrom to a series of contact terminals and an auxiliary winding also having leads extending therefrom to a suitable switching device and which has its end terminals connected to contact devices for making engagement with the contact terminals of the main transformer winding.

734,442. TROLLEY; Harry Spurrier, Montreal, Canada. App. filed Oct. 2, 1900. A trolley provided with means for automatically causing its wheel to turn and meet the curves of the trolley wire simultaneously with the turning of curves in the rails by the car.



734,424.—Commutating and Current Shaping Device.

734,450. STATIC MACHINE; Henry E. Waite and Harry F. Waite, New York, N. Y. App. filed April 4, 1903. Provision for mounting any number of plates upon an axis.

734,456. AUTOMATIC BRIDGE FOR ELECTRICAL LOOP LINES; George E. Brett, Philadelphia, Pa. App. filed Oct. 23, 1902. A simple form of main line circuit closer combined with main and loop line terminals so that it will be readily accessible to the lineman and can be handled by him without risk.

734,476. ART OF TRANSMITTING INTELLIGENCE; Harry Shoemaker, Philadelphia, Pa. App. filed Jan. 8, 1903. An instance of the use of the Poulsen telegraphone as a receiving, recording and reproducing device for the signals in wireless telegraphy.